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ENVIRONMENTAL ISSUES FACING THE STATE OF NEW MEXICO

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BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

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ENVIRONMENTAL ISSUES FACING THE STATE OF NEW MEXICO

WEDNESDAY, JULY 6, 1983

U.S. Senate,
Committee on Environment and Public Works,
Albuquerque, N. Mex.

The committee met at 1 p.m. in the city council chambers, City Hall, Albuquerque, N. Mex., Hon. Pete V. Domenici presiding.

OPENING STATEMENT OF HON. PETE V. DOMENICI, U.S. SENATOR FROM THE STATE OF NEW MEXICO

Senator Domenici. Could we have attention, please.

As I indicated in my opening remarks to the press, it's with a great deal of pleasure that I open this hearing for the Senate Environment and Public Works Committee to receive testimony on major environmental issues facing New Mexico. I believe we are fortunate to have with us the newly appointed Administrator of the Environmental Protection Agency, William Ruckelshaus.

As we indicated before, we are here to listen and to learn from our witnesses about issues within the purview and jurisdiction of the Environmental Protection Agency. Bill Ruckelshaus has taken over the reins of the EPA at the time when the Agency has indeed been suffering.

The Agency, during the last 2 years, has lost significant confidence of the American people, and has been perceived as having abandoned some of its environmental missions. I am confident that Bill Ruckelshaus will restore the confidence of the American people.

Today's hearing is an important one for Bill Ruckelshaus because our State is unique. On the one hand, we are blessed with a natural heritage that, in my opinion, is unsurpassed. On the other hand, we are blessed with natural resources that provide jobs and revenue to our State. In most cases, we have been able to balance these two concerns; the concern to provide for growth and investment without sacrificing the beauty of our State. Therefore, I believe we have set an example for other States. By all working together, we have been able to resolve many issues by balancing all concerns. The prevention of significant deterioration program is a perfect example of a system designed to balance growth and environmental concerns. It has a special meaning in New Mexico where we don't want to prohibit investment, but we also don't want to repeat the mistakes of the East.

There is a strong support for a program like this in our State. This is not to say that we don't have differences. We do. I expect today we will receive testimony expressing different viewpoints. But these differences should not, and usually do not, prevent us from reaching a consensus on many environmental matters.

We are also fortunate in this State to have a research community that is studying many of the pressing issues facing our country today. Today we will draw from our universities and national laboratories to hear from a number of distinguished scientists and researchers who are performing critical environmental research.

I anticipate that the major focus of today's hearing will be on the Clean Air Act, the Clean Water Act, uranium mill tailings regulations, and hazardous waste disposal. We will have three panels. The first panel is comprised of State and local officials.

The second, of the environmental and industrial community, and the third is a panel from the New Mexico research community.

All in all, this should be an educational afternoon for all of us, and I am pleased that we have the opportunity to schedule the hearing, and certainly to lure Bill from his duties at EPA to come and be with us.

I would now ask if the Administrator would have some opening remarks. Before he does that, I will announce now that we will try to finish by 4. We might go as late as 4:15, 4:30.

Bill, do you have any comments?

OPENING STATEMENT OF HON. WILLIAM D. RUCKELSHAUS, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY

Mr. RUCKELSHAUS. Only to echo what you have already said, Pete, and also to emphasize something I mentioned a moment ago. Namely, that I think Senator Domenici has correctly stated some of the great natural resources that this State has. He has been modest enough not to mention one of them; namely, himself, as a member of the Senate Public Works Committee. He has a vital role in overseeing all the schedules that EPA administers. And it's through his long service on that committee, his knowledge of these laws, and his wisdom that he brings to bear on them that I think we have a great opportunity now to see those laws reauthorized, and to bring back some predictability into our environmental and public health regulation.

I think that for me to have an opportunity to hear firsthand, in a State like New Mexico and a city like Albuquerque, the problems that are faced by the State and local officials, by others who have firsthand knowledge of the problems, is a rare opportunity. Too often I think, in jobs such as the one I am now in, we spend an inordinate amount of our time in Washington thinking that we know all that's going on nationwide. And, in fact, unless we see firsthand what some of the problems are, there is no way we can wisely administer these laws.

So I am delighted to be here. Delighted to get an opportunity to listen to these fine panels that have been assembled by Senator Domenici, and to learn what some of your problems are firsthand.

Senator DOMENICI. Thank you very much, Bill. The first panel will consist of the mayor of Albuquerque, the Honorable Harry Kinney. He is accompanied by Larry Gordon, Albuquerque, director of Environmental Health and Energy Department. We welcome both of you. The Honorable Robert McNeill, secretary of New Mexico Health and Environment Department. Bob, we are pleased to have you.

And the Honorable Robert White. Bob is the president of the Albuquerque City Council. We are delighted to have you.

Tom Udall, acting director of the Environmental Improvement Division. Tom, we are delighted to have you.

I have penciled in what I thought would be a good timeframe, and, hopefully, we can take no longer than 45 minutes for this panel. Maybe you won't even need that much. But that gives you 10 minutes or so for each of your primary statements, and a little time for questioning. The other witnesses might not have as much, but, hopefully, we can keep it on schedule.

Mayor, will you proceed?

STATEMENT OF HON. HARRY KINNEY, MAYOR, ALBUQUERQUE, N. MEX.

Mayor KINNEY. Thank you very much, Senator Domenici and Mr. Ruckelshaus. I think it's great to have you back in the warm environment of this meeting room. We have sat through a few meetings under warm conditions together, and it didn't seem to deter you from keeping it up.

I am Harry Kinney, mayor of Albuquerque. I am very pleased that you have chosen to conduct a field hearing on environmental issues here in Albuquerque. I want to discuss with you today some of the concerns I have with the current direction of environmental programs under the Clean Water Act and then propose some changes in direction which I believe need to be taken. As a specific example of a project representative of one new direction which looks very promising, I will give brief mention to the irradiation of sewerage sludge.

Before I begin, I would first like to commend the Federal Government for their final decision to proceed with construction of the WIPP project near Carlsbad. As one who has spent about half of my adult life working with nuclear materials, I feel qualified to speak on the subject. Since the early days of Los Alamos, nearly 40 years ago, nuclear waste material from weapons research and manufacture have been buried in various locations in New Mexico and other places in the United States a few feet below the surface in containers that were not designed for long-time storage.

The best brains in our Nation have concluded that storage in salt beds, such as at the WIPP site, is the most suitable long-term storage method. I firmly believe the environment of our State and Nation will be improved by utilizing the WIPP site for nuclear waste storage. I believe the studies that will be conducted at the WIPP facility will lead us to a permanent solution to the proper storage of all nuclear waste material.

Now, to the problem at hand. Congress, in the Clean Water Act, supported the development and implementation of innovative and alternative technologies for wastewater treatment. They did this through special set-asides of each State's share of the allotment for construction. The set-asides can range from 4 to 7½ percent of the State's allotment, to raise the Federal share of project funding from 75 to 85 percent.

Once the Federal share starts dropping, Congress provided that I/A projects would receive 20 percentage points more funding than conventional systems, but never more than 85 percent. In other words when conventional systems receive 65 percent, I/A will receive 85 percent; when the share for conventional systems drops to 55 percent, I/A systems will receive 75 percent.

The intent of Congress in supporting new technologies was also made clear in provisions specific to research and development, from authorizing grants specifically for R&D programs—section 105—to specifying cooperation to work with State and local governments in establishing programs for the "prevention, reduction, and elimination of pollution"—section 104. Many fairly spectacular innovative programs are described by this section of the law: Health effects research, establishment of field laboratory and research facilities, basic and applied research on treatment technologies, establishment of a national clearinghouse on waste water treatment information, and a great many other studies, including projects for the treatment and disposal of sewage and liquid wastes with solid wastes.

Funding for EPA's R&D programs has not been at a level to enable the Agency to take advantage of congressional authorizations, however. The entire EPA budget for R&D programs in the water media has been in the $20 or $25 million range for the past several years. The Municipal Environmental Research Laboratory in Cincinnati has been winding down many of its research programs which have been a mainstay in the waste water field.

Bringing the focus of my discussion back to Albuquerque, I would like to describe for you a local innovative project which is a perfect example of the type of project that both the Congress and EPA feel is a desirable, beneficial project, but that there is currently no funding available for. This is the irradiation of municipal sewerage sludge utilizing spent nuclear fuel.

Albuquerque has been selected as the first demonstration site for the purification of municipal sludge, in order to make it more amenable for land application to parks and other public facilities. Use of the spent nuclear material, cesium-137, will serve as an experimental springboard to the material's utilization in other industries, most notably the food and medical industries. In the food industry, there is great potential for using low doses of cesium-137 for insect and parasite control, and for sprout inhibition.

The Albuquerque waste water treatment facility treats 40 million gallons per day. By 1990, we estimate the flow will be 60 million gallons per day, producing an estimated 10,740 tons per year of dry solids. An environmental impact statement was prepared for Albuquerque to evaluate all possible alternatives for the management of these sewage wastes. Among the 14 options considered was no action, in other words continued use of sludge drying beds. Because of aesthetic and odor problems, in addition to insufficient capacity of the drying beds and the pending unavailability of the disposal sites for sludge treated in this manner, the no-action option is not viable.

The option chosen by the city of Albuquerque, and recommended by a specially convened citizens advisory committee, was irradiation with cesium-137 and continued beneficial use of sewage sludge. I would like to note at this point that the project has received EPA's approval as an innovative project, and is eligible for funding under the construction grants program at an 85-percent level of Federal support.

Specific advantages of the sludge irradiation include its beneficial usage of several waste materials—beneficial use rather than simple disposal. The sludge, disinfected by the spent nuclear material, has a number of potential uses which have been determined safe in studies by the Sandia National Laboratories. Disposal of part of the disinfected sludge as now planned would be accomplished through land spreading on city parks and golf courses. Sale of bulk sludge to public turf managers and of bagged sludge to home gardeners is being evaluated; this would have as a fringe benefit the generation of revenue for the city. Another potential use being studied includes use as a fertilizer for crops.

The Albuquerque sludge irradiation project will have a total cost of $31 million. Construction of the actual sludge irradiator has been promised by the Department of Energy, a $3.5 million commitment that will be lost if construction does not begin soon. Local and State governments have committed $6 million to the project. That leaves an additional $22 million to be funded, for construction of the ancillary pipelines, pumping stations, and a solar-heated sludge drying process. While that $22 million is eligible for EPA funding, the EPA grants program does not have sufficient money available to make this project a reality.

The entire fiscal year 1984 allotment to the State of New Mexico will be approximately $1.9 million. The reserve funding portion of this allotment is $59,580, which would not even begin to offer assistance at the level needed. The entire State's allotment minus set-aside reserves drops to $9.77 million available for construction. Under a State proposed change to the State priority list, however, there would be a new reserve set up for small communities, bringing the statewide balance for construction down to just under $8 million. At this level, even if the sludge irradiation project received this entire sum, it would take 3 years before sufficient funding would be received. And even supposing the irradiation project did receive this funding for 3 years, the project could not be segmented to be built over a 3-year period; nor under the Clean Water Act, could the funds be held for 3 years until $22 million accumulated.

The city of Albuquerque does not, of course, receive the entire State's share. Albuquerque treats 80 percent of the wastewater flow of communities on the current State priority list, and 50 percent of the wastewater flow in the entire State, yet since 1970 has received only about 5 percent of the EPA grant money for treatment plant construction. In effect, the level of funding in the construction grants program precludes it from being funded at a realistic level.

I've brought two problem areas to your attention: The large issue of a dearth of funding for innovative waste water treatment programs, and the specific shortage of funding faced by Albuquerque. The solution I propose which would remedy both of these problems is to legislate a new provision into section 104 of the Clean Water Act, to authorize $200 million a year for costly, innovative programs associated with waste water treatment, to be obligated to specific programs at the discretion of the Administrator of the Environmental Protection Agency. Under this provision, exceptional projects would receive a special, fast-track treatment to enable them to proceed on a track separate from conventional projects.

There are two primary reasons which I feel make the Albuquerque project deserving of such treatment. First, the project would be a demonstration of an innovative technology which could be of benefit far beyond this project's scope, and even holds out the hope of eventually paying for itself. EPA has estimated that, for fiscal years 1979–81, the expenditure of $55 million in innovative set-aside funds would result in construction cost savings of $345 million—a return of $6.32 per dollar spent. While we do not anticipate a six-fold return on our dollars here in Albuquerque, the track record of innovative projects in general places us in good company. Second, this project would benefit a major metropolitan area which, although it serves half of the State's sewered population, has received a small fraction of the State's share of construction grants.

This second point, lack of funding proportioned to population served, has been a problem with many other large cities. While not the central issue to my testimony today, I would like to briefly describe for you a proposal developed by the Association of Metropolitan Sewerage Agencies to remedy this disparity. Called separate track funding, under AMSA's plan, a separate administrative track would be established for large grantees of demonstrated competence. The grantees, once their basic facilities plan had been approved by EPA, would draw funds out of a separate account, specifically authorized by Congress, based on a list of projects of certified grantees. If the Congress chose to cut funds from this separate budget, it would be aware of just which projects would be eliminated.

Another program change to the Clean Water Act which would benefit cities such as Albuquerque is greater local control over the program governing pretreatment of industrial wastes. We most definitely do not seek to opt out of pretreatment; rather, we seek the flexibility in the national standards to enable us to set the discharge limits on industry which will best protect our facility, the public health, and our sludge. And the standards in our case would likely be very stringent because our planned utilization of sludge makes it in our best interests to have a sludge with very low levels of heavy metals.

This concludes my prepared statement. In summary, I would like to reiterate that the need still exists nationwide for new, innovative technology. I urge your consideration of a separate EPA authorization for demonstration programs which would fund costly, innovative projects. Such a program would provide a substantial, much-needed boost to both innovative technology and to the Nation's waste water treatment program.

Mr. Larry Gordon has another concern of ours that will follow as you call him. Thank you so very much.

Senator DOMENICI. Thank you very much, Mayor. Mr. Gordon, you may proceed. We will hold the questions unless they come to us spontaneously; in which event, Bill, feel free to ask. But we will let everybody testify.

STATEMENT OF LARRY J. GORDON, DIRECTOR, ENVIRONMENTAL HEALTH AND ENERGY DEPARTMENT, CITY OF ALBUQUERQUE, N. MEX.

Mr. GORDON. Mayor Kinney has requested that I testify today regarding management of hazardous waste at the local level. At first blush, it might appear that hazardous waste would not be a significant issue in a relatively unindustrialized area such as Albuquerque located in the arid Southwestern United States. While it is true that we may not have the variety and volumes of hazardous waste that are generated in heavy industry areas, we do have our own type of problem, which we have not yet fully defined and analyzed, and which probably represents only the tip of the iceberg in terms of the real problem which will become more evident in future years. Our water resources in the valley area are shallow and can be polluted easily. Improper disposal of hazardous waste for the past 30-some years is only now becoming better understood. Hazardous waste has been dumped on our mesas and our arroyos, along river banks and ditches, along highways, in vacant lots, in landfills and sewers, and in alleys for many years. It is probable that migration and leaching of such wastes into the ground water takes more time in this area than it would in the Eastern United States due to the meager annual precipitation. Therefore, we may yet feel the pollution impact in our water supplies caused by improper dumping during the past several decades. We know of some of this, as evidenced by the pollution analyzed in two city water wells and a number of private water supplies in the valley area. As you know, this specific issue has been designated under the Superfund program.

Hazardous wastes from larger generators do not represent a serious problem inasmuch as they are probably reasonably well identified, licensed, and regulated under the Federal-State hazardous waste program. Therefore, the majority of the unregulated hazardous wastes in this area come from households and small businesses which are not subject to the Federal-State program requirements. As yet, we have no system for regulating the storage, transportation, treatment, and disposal of such wastes. Therefore, they are variously discarded into landfills and sewers as well as strewn on our mesas and valley landscapes.

I believe the drafting and enactment of the hazardous waste provisions of the Federal Resource Conservation and Recovery Act inadvertently precipitated a major problem in that it failed to take appropriate notice of the essential role of local governmental entities in the management of hazardous wastes, and effective hazardous waste management must represent a coordinated partnership involving Federal, State, and local governments, as well as generators, transporters, disposal facility operation, and various citizen groups. It's only reasonable to conclude that local governmental officials may be the first to know of hazardous waste incidents, may be the first on the scene, may be the first to be contacted for reliable information, and are expected to insure cleanup following a spill.

In the Albuquerque area, we are designing a hazardous waste management program to enhance and complement the Federal-State program, but such a program is not envisioned or encouraged through the Federal-State program, nor does it receive planning and implementation funding.

As yet, I do not feel that State and local officials in New Mexico are suitably prepared to handle a significant hazardous waste incident. The last New Mexico Legislature enacted a Hazardous Waste Act which does not adequately envision the essential role of local governments. Realistically, hazardous waste incidents in this area must be handled initially, and perhaps on a continuing basis, by local police and fire officials who have the manpower, the equipment, and the training to react to such an emergency. State officials could not possibly respond on the proper scale or in the proper timeframe expected to offer consultation and coordination until some hours after the fact. Our City Office of Emergency Preparedness was worked with local law enforcement officials, fire officials, and others largely on its own volition. But realistically, there continues to be insufficient planning and coordination with State and Federal officials—probably due to the statutory and regulatory design of the Federal-State hazardous waste program.

Regrettably, a public and official attitude has developed throughout our Nation that storage and transfer, transportation, and treatment, and disposal of hazardous waste should be handled by the private sector. I fully support this when the private sector is able and willing to effectively handle the task and make a profit in so doing. In an area such as this, private sector involvement has thus far failed to materialize. It is interesting to note that we have long accepted the fact that solid waste management can be handled by local government, and air pollution management, through mass transit mechanisms, can be handled by local government. But curiously, hazardous waste management treatment facilities have frequently not been seen in the same light.

In the Albuquerque area we are now taking initial steps to propose governmental funding for a properly located hazardous waste storage and transfer station and a properly located treatment and disposal operation. As an environmentalist, I prefer the proper management and regulation of such operations in this area over the present indiscriminate and dangerous dumping of hazardous waste in our environment. There may be those who do not believe we should have such hazardous waste management facilities in this area, but I suggest that such facilities are more desirable than the current practices which pollute our environment.

We should hope that EPA, through regulation, consultation, research, demonstration, and funding would insure the development of waste exchange, recycling, resource recovery, and changes in manufacturing processing designed to eliminate some hazardous wastes as end products as superior alternatives to secure landfill disposal.

Senator Domenici, Mr. Ruckelshaus, in closing, let me simply summarize my testimony by emphasizing the need for a partnership with local government if hazardous waste programs are to effectively protect our environment and the public's health. Thank you.

Senator DOMENICI. Thank you very much, Mr. Gordon. Secretary McNeill, we are delighted to have you here. If you would proceed now, we would be pleased to hear from you.

STATEMENT OF HON. ROBERT P. McNEILL, SECRETARY, DEPARTMENT OF HEALTH AND ENVIRONMENT, STATE OF NEW MEXICO

Mr. MCNEILL. Thank you very much, Senator. I would like to commend you for holding this hearing and say that we are very happy that Mr. Ruckelshaus is here with you.

My name is Bob McNeill. I am the secretary for health and environment of the State of New Mexico. On behalf of Gov. Toney Anaya and the people of New Mexico, I appreciate the opportunity to appear today and discuss some of the environmental issues of concern to New Mexico. I will highlight my prepared statement and attempt to keep my verbal comments brief. A strong, viable Federal EPA is of paramount importance to New Mexico and to the Nation. Many of us in the New Mexico Health and Environment Department had the privilege of working with EPA and indirectly with Mr. Ruckelshaus during his first tenure as administrator, and we were very pleased when he was reappointed by President Reagan. But I would hasten to point out that neither Mr. Ruckelshaus and EPA nor the States can do the job mandated by the various environmental laws without a much greater commitment in budget and manpower than we have seen these past 2 years.

We strongly urge the Congress and the EPA to propose and support more realistic appropriation levels for EPA, and we hope the President will follow through on his wise appointment of Mr. Ruckelshaus with budget requests that also represent a commitment to strong environmental protection.

Mr. Chairman, there are several areas of environmental concern which will be before the Congress this year either during budget deliberations or reauthorization deliberations. Because our agency has administrative and regulatory responsibilities in most, if not all, of these areas, I want to comment on several programs of mutual concern.

First of all, in regard to radiation protection, the State of New Mexico will formally comment on EPA's proposed regulations for active uranium mills and uranium mine emissions.

To briefly summarize our State's position, we believe there are several areas in which EPA's proposed regulations must be strengthened.

Because of threats posed to public health, uranium mill tailings must be isolated from mankind and the environment for thousands of years, and the standards must reflect this requirement. We believe that the proposed EPA standards are inadequate in this respect.

We support the EPA proposal to regulate uranium mine radon emissions as this is the largest source of radon associated with uranium mining and milling in New Mexico. However, EPA should strongly consider placing more emphasis on measured values rather than modeled ones to determine compliance.

Also, the proposed EPA regulations, in our judgment, do not adequately recognize the long-term hazards and relative importance of continual discharge of mine waters to surface drainage. Such discharges in New Mexico have resulted in potential long-term contamination of domestic animals and man's food chain.

I would like to say a word about a most important radiation insult. During our study of radon in the uranium production areas we have become aware that it is really radon daughters that injure people. A case in point is past uranium mining practices. Senator Domenici held hearings in Grants several years ago which dramatically demonstrated the injury caused by radon daughters to uranium miners in the late 1940's and the early 1950's. The Environmental Improvement Division has acquired instrumentation to determine radon daughter concentration in homes. We were shocked to find that radon daughters concentration in homes not even remotely connected with the uranium industry could reach alarming values. This is due in part to the soil under the home and is exacerbated by attempts to seal the home against heat loss. The EPA estimates that between 6,700 and 13,400 cases of lung cancer per year are attributable to radon daughters. We plan to enlarge our program in the hope of learning how to minimize this threat to New Mexicans. We would appreciate EPA's attention to this problem which may be one of the most important radiation problems we have today.

With regard to clean air, as a Senate staff member 13 years ago, I was fortunate enough to participate in the drafting of the original Clean Air Act of 1970, and I was very distressed last year with the administration's efforts to weaken the law. Our State strongly supports the 1977 amendments to the Clean Air Act as representing an increased national commitment to cleaner, healthier air. Strong Federal legislation has provided the necessary legal framework supporting New Mexico's very successful regulatory efforts over the past decade. This success has been rather strikingly reviewed in a recent study of statewide air pollutant emissions. Citizen groups, our State government, and New Mexico industry all point to the fact that total emissions of sulfur oxides and particulate matter are now controlled to the level of the 1940's. Accordingly, we are confident that energy and economic development can continue without compromising efforts to attain and maintain air quality standards designed to protect health.

The department has witnessed improvements in EPA review times, in EPA's support for technical training and the Agency's provision of expert witnesses at State public hearings. EPA has also shown evidence of a newly active role in its support for New Mexico's concern for controlling emissions of lead from the ASARCO smelter in El Paso, Tex. Acceptable lead levels must be restored to the Anapra/Sunland Park area where seriously high measured levels of lead have been determined. Our State urges EPA to continue to strengthen efforts to bring this smelter under control in terms of air contamination.

I would like to commend the Administrator for his withdrawal of the EPA economic sanctions policy as proposed on February 3 of this year. Mr. Ruckelshaus, your policy tracks well with the State's position on EPA's previously unreasonable interpretation of the Clean Air Act. The previous policy would clearly maximize economic disruption to areas of the State which have shown good faith efforts toward compliance with the Federal law.

To further ensure New Mexico's compliance with the Clean Air Act, the department urges your Agency's prompt promulgation of its nonferrous smelter order rules and inhalable particulate standard. These are truly "moving targets" causing unreasonable regulatory uncertainty, and they clearly go against the intent of Congress.

The department supports the vehicle emissions testing program now in place in Bernalillo County. With carbon monoxide being a potentially more serious health problem at high altitudes, we hope that this program will reduce this pollutant to healthful levels by the Federal deadline of 1987. However, the pressure of a mandatory rule such as this one accompanied by the threat of sanctions should be part of a balanced national approach which would provide continued stringent rules for the automobile manufacturers themselves. The attainment possibilities are questionable enough with the present (CO) carbon monoxide tailpipe standards.

Tomorrow, the New Mexico Environmental Improvement Board will be holding a public hearing to consider the adoption of a New Mexico prevention of significant deterioration regulation. With its adoption, the State would soon be on its own in the PSD arena. As you know, the State has long supported the concept of PSD as essential for protection of the unique characteristics of western air quality. We are anxious to complete the turnover of this program to New Mexico from EPA.

With regard to clean water issues——

Senator DOMENICI. Bob, do you know that the State's on the verge of taking over the PSD program? Do you know if any other States have done that?

Mr. MCNEILL. Is anyone here from our Air Quality Bureau?

Ms. WILLIAMS. I know some States have taken over PSD authority, but I don't know which ones.

Senator DOMENICI. When we were marking up the bill, there were none. There were a lot of concerns about its complexity. States had said they did not want to administer it. It would be interesting to know which States have. Would you mind communicating with us on which States have?

Mr. MCNEILL. We will prepare that and submit it to you, Senator. We will also apprise you of the results of the hearing. (See p. 125.)

With regard to clean water issues, we would like to encourage both Congress and EPA to recognize the need for continued Federal funding for construction of municipal sewage treatment plants at least at the present level through 1988. Of course, present level is not really adequate to address the enormous demands that are placed on this program. Realistically, the need for Federal support in New Mexico will extend for several years beyond that date.

New Mexico implemented standards and regulations to protect ground water in the spring of 1977, and I believe we were one of the first States to do that. Those regulations have considerable testing in the courts, and with minor exceptions have been upheld by our State supreme court. Over 230 sources have been permitted under those regulations without demonstrable failure.

New Mexico has strived to comply with EPA regarding mandates of ground water protection, and the EPA has demonstrated some flexibility in accommodating the State's point of view. Unfortunately, even this small amount of flexibility is missing from EPA's interpretation of the new hazardous waste land disposal regulations under the Resource Conservation and Recovery Act. For the State to administer these regulations, we are told word-for-word adoption of the Federal regulations is the only acceptable approach. In my opinion, this is not the best way to achieve workable, effective regulation. I do appreciate the need for some degree of uniformity in regulations nationally, but would suggest that such uniformity can be accomplished as effectively in looking at performance rather than specifying design. I believe this issue was discussed with you, Mr. Ruckelshaus, when some of us met with you in Washington in late May, and I recall that you were sympathetic, but I souldn't put words in your mouth, and won't.

It is interesting to note that the protection of ground water seems the vehicle for better integrating several of the major environmental programs which have been operating as though they were independent and unrelated for too long. The effort toward integration is commendable.

With regard to the issue of toxic wastes, it should operate to force a degree of integration. There is a crying need in the area of toxic and hazardous waste for additional research which would give both EPA and State programs the necessary basis for establishing numeric criteria.

Superfund is another major issue facing the country and the State of New Mexico with regard to environmental issues with regard to the Federal Comprehensive Environmental Response, Compensation and Liability Act of 1980, known as Superfund, which was enacted by Congress to provide for the cleanup of inactive hazardous waste disposal sites and to establish liability, compensation, cleanup, and emergency response for hazardous substances released to the environment.

EPA, back in October of 1981, published an interim list of 115 top priority response target sites which was subsequently expanded to 160 sites in July 1982, and to 419 sites in December 1982. Four of the 418 sites are located in New Mexico. They include: Albuquerque South Valley, Homestake Mining Co., Milan, N. Mex., Atchison, Topeka and Santa Fe Railroad, Clovis, N. Mex., and United Nuclear Corp., Church Rock, N. Mex.

EPA has increasingly come under public criticism for what is perceived as a failure to implement this act in an expeditious manner. This criticism appears to be largely due to public expectations for timely remedial actions on priority sites not being met.

I also share this concern for timely remedial actions regarding the listed sites in New Mexico. For example, during September 1981, remedial response fact sheets for the Albuquerque South Valley and the Homestake Mining Co. sites were submitted to EPA Headquarters by the Region VI for funding consideration to initiate the remedial investigations. To date, the remedial investigations at these two sites have not been initiated. Similarly, EPA negotiations regarding remedial investigations at the UNC site and the A.T. & S.F. Railroad site have been underway since at least February 1982, and July 1982, respectively, with no resolution to date. Thus, lengthy delays in the implementation of remedial investigations at the four New Mexico sites are of great concern to me.

Additionally, we understand that a request was made to EPA Headquarters by EPA Region VI during September 1982, to set aside $350,000 to fund the investigation and feasibility studies at the Albuquerque South Valley site. Pursuant to a section of the act, the State will be required to provide 10 percent of the cost of investigation and feasibility at the site which translates into $35,000, based on the September 1982, funding request. However, the New Mexico Environmental Improvement Division of the Health and Environment Department informs me that EPA's present cost projection for the Albuquerque South Valley site is approximately $847,000. An escalation of that amount in the 10 percent amount is very troubling. And how are States expected to appropriate the necessary funding when these costs become moving targets?

Finally, regarding the United Nuclear Corp. site, EPA Region VI is finalizing an administrative order to be sent to the corporation. As I understand, this order would set up a time schedule for an investigation and the development of a plan to clean up the site. However, indications are that EPA Region VI is not certain, even after months of expended efforts involving the technical and administrative assistance of the State, that EPA Headquarters will allow this administrative order to be filed. On this point, I suggest a policy be developed giving the EPA Regional Office greater discretion in dealing with individual States and making site-specific decisions. Often, such enforcement documents, draft contracts, reports, and agreements or decisions mutually approved by the State and the EPA Regional Office are rejected or unacceptably altered by EPA Headquarters. This causes delay in implementation and a concomitant increase in costs. Many of these delays are the result of EPA Headquarters' staff's unfamiliarity and lack of involvement with individual sites. These difficulties are often trivial and could be avoided by some degree of decentralization in the Superfund implementation program.

In conclusion, let me thank you, Senator Domenici, for conducting this hearing in Albuquerque today, and Administrator Ruckelshaus for joining Senator Domenici. I recently had the opportunity, along with a number of State environmental officials, of meeting with Mr. Ruckelshaus in Washington. That meeting was reassuring. I recall one comment the Administrator made concerning the need for a stronger scientific base for policy decisions in environmental matters, and I was pleased to hear that Mr. Ruckelshaus recently addressed the National Academy of Sciences on that point. As a State official, I can confirm that we share a concern that policy making in this area be as scientifically sound as possible. Particularly in the areas of hazardous and toxic waste, we need to know more about how great the risks are in order to intelligently define policy.

One final comment. I noticed Mr. Ruckelshaus' comments in the June 26 issue of the Washington Post. There is an excerpt from a speech that you gave. We hope that you are still pleased with your position. You said in that speech that your original view when you left the job 10 years was that you simply had to balance our desire to eliminate pollution against the costs of its control, and that might require some adjustment of the law, but that could be done, and we should be able to have the system in place by 1976. And I think you said that that view turned out to be somewhat in error. And you think that maybe God is repaying you for your error by causing you to be reincarnated as administrator. And you said, whether it was God or President Reagan, you are determined to improve our country's ability to cope with pollutants. I would like to compliment you for that remark and tell you we are behind you all the way. Thank you very much.

Senator DOMENICI. Have you decided who it is, yet?

Mr. RUCKELSHAUS. I have suspicions as to who it is. That is an accurate comment. In fact, some of the points you made as they relate to Superfund, we have already tried to address, including the 10 percent requirement that was initiated by regulations that the States have come up with, initial remedial stage. That is no longer true. We can go forward with the cleanup without the State coming up with that 10 percent matching fund. The construction phase of it, in that the statutes could require a 10 percent State matching fund. So I think whether it is as a result of God or President Reagan's intervention, we have at least attempted to meet some of your concerns in Superfund.

Mr. MCNEILL. We applaud your decision on the 10 percent. That was very important in the State of New Mexico.

Senator DOMENICI. What that will do, as I understand it, Mr. Secretary, is it will eliminate the shooting target, the Federal Government will pay the up-front money. Then a specific construction dollar amount will be determined, and it's to that construction that the 10 percent will apply. Is that not correct?

Mr. RUCKELSHAUS. That's right. There also has been a greater delegation to the EPA regions to work these sites with the States. There has been a requirement that we break the question of who pays for the ultimate cleanup from the actual cleanup itself and the two separate phases. We don't try to answer the question of who pays before we go ahead and start cleaning it up. All of these things have had the effect of accelerating the cleanup of sites around the country. And I think we will begin to see the results of those policy changes very quickly.

Senator DOMENICI. Before we go to the next witness, let me comment on one other of your points. With reference to funding for EPA, that is their staffing, we have now completed work on that. The President's original budget request was $3,703 million. We waited in the Senate for Administrator Ruckelshaus to send us his suggested add-on by way of R. & D. and staffing needs. We are very fortunate. He requested $265 million additional funding. We gave him that in the Senate, and then on the floor we added $30 million for combined sewer overflow—part of his job—for a total of $3.998 million. We went to conference with the House; they had slightly more than that. They accepted the $3.998 million as the budget, and I understand that will add 300 employees to his Superfund personnel, and 850 to his regular EPA staffing. And he has told us that he might affirm this, that this is what he thought he could assimilate in the year of 1984 in order to get on with the job he's charged with. You might want to comment on that. I think those are the correct numbers.

Mr. RUCKELSHAUS. Yes. That's right, they are, Pete. The Congress, in reviewing EPA's budget concluded much as you suggested, Mr. Secretary, that there was need for additional funds. That was one of the subjects that I discussed with the President and accepted the job that I was going to look at the budgetary needs of the Agency and determine whether we needed additional resources.

There is a point beyond which expansion becomes very difficult. On a base of about a little over 10,000 employees to increase at a rate of 12 or 13 percent is about what we think we can assimilate in any one year. And we will be hard pressed to spend that money wisely.

There are obviously enormous needs in this environmental area, not only in the Superfund, but a lot of others that are eventually going to have to be met. You have touched on a couple of them here, including the sewage treatment plant in the Grants area. And I think those in the future are going to have to be addressed with a considerable amount of aggressiveness by the country. But at this stage, I think the increase in funding is going to be very helpful to us in meeting our term goals.

Senator Domenici. Before I go to the President of the Council, while I am talking on this issue, and while Mr. Ruckelshaus has brought up sewage treatment and EPA grants for cleaning up sewage and water, as you know, Mr. Secretary, we have been successful here in the South Valley in starting a program to build some collector systems in an area that had none. That was predicated upon a health hazard in this area. And certainly the State, the city of Albuquerque, and the Federal Government's money has made one giant stride. But there is still a lot to be done there.

It's my understanding that the law that we passed for a new 5-year extension of this program at $2.4 billion a year, when that bill left the Senate, we had, as you remember, that the national program was to concentrate on treatment plants, and to get out of the business of constructing collector systems on the basis that we wanted to handle past problems and not future growth. But we made an exception that we could use this money for collector systems that had been started. That was done principally in the Senate because of our problem in the South Valley and a couple of other in the Nation.

When we came out of conference with the House, we formulated a more simple approach, in that we built in a 20 percent discretionary pot of money for the State to take out of its annual allotment to use for collector systems, using their prioritization vis-a-vis any other applications. Your people understand that is the situation with reference to the $11–12 million we receive each year? I have been asked to confirm that that's the case, and I can only tell them that's the law. I would like you to reassure them that it's a priority issue, not an issue of authority.

Mr. McNeill. Senator, it's very much a priority. And I have here the conference report on the municipal waste water treatment construction grants' amendments of 1981, and I certainly agree with your interpretation of the statute, and appreciate your comments, which we are pleased with. We are pleased with the results in the conference report and, again, this particular project is a very high priority item with our State Department, and we will continue to make every effort to be responsive to the needs of the project, using this authority which does indeed give the State some discretion to use up to 20 percent of its allotment for such problems.

Senator Domenici. Thank you very much. We are delighted to have Robert White, president of the city council.

STATEMENT OF ROBERT M. WHITE, PRESIDENT, CITY COUNCIL OF ALBUQUERQUE, N. MEX.

Mr. WHITE. My name is Robert White. I am president of the Albuquerque City Council. I appreciate the opportunity to testify today on behalf of the Albuquerque City Council and the citizens of this area. I am pleased with the changes that have recently taken place in EPA and with the apparent renewed emphasis on environmental protection which is so important to the world, this Nation, and the health and environment of this State and area. Albuquerqueans and New Mexicans have a long history of insisting on effective environmental health programs to protect our environment and the health of our citizens. Our citizens have repeatedly shown through legislation and funding that our environment is our prime asset, that it must be adequately protected, that we can't have a viable economy without a quality environment, and that our environment once degraded or destroyed may never be returned to satisfactory quality. We know that effective protective measures must be continued and in some cases instigated to prevent environmental degradation, and to provide a high level of environmental health standards and regulations. We also know that we cannot, and should not, delay taking action until every final shred of evidence of damage is known. We are also aware that technology exists to adequately control pollution and that absence of such controls frequently reflects a lack of political will rather than the absence of technological capability. Certainly our citizens demand and deserve a quality environment for reasons of health, safety, comfort, and well-being.

Perhaps this area is somewhat unique in that it still has options open to determine its own environmental future for this and future generations. This area has a delicate ecological balance and environmental protection measures must, therefore, be of some preventive nature. I have no doubt that life can continue in some manner in a grossly polluted environment, but I feel that we should thrive rather than merely survive.

The Albuquerque City Council has reacted positively to funding needs and requests, and has taken reasonable action to provide for effective local environmental health programs to protect environment and our citizens, and to fill gaps where State and Federal activities are not adequate to our needs and expectations.

It has been understandable and expected that a few segments of our society opposed to environmental protection activities have attempted to create a backlash and turn public opinion against this essential public health measure. It is obvious that such efforts have not been successful, as indicated by results of the aforementioned public opinion polls. Costs of environmental health have been exaggerated by some of these interests. Studies have indicated that the effect of environmental protection programs on the economy and on inflation have been insignificant, while at the same time such measures have created new jobs, new industries and, in many cases, substantial new tax revenues for State and local governments.

As you are rebuilding EPA, we hope you will have appropriately trained and experienced environmental scientists who will bring credit to your Agency and environmental quality to this Nation. We recommend that you set a tone so that EPA policymakers are accessible to State and local officials and work with State and local officials rather than on them. Certainly more input, coordination, and cooperation is necessary in this area.

Additionally, we are vitally concerned that there be no weakening of key Federal environmental measures pertaining to air and water pollution, water supplies, solid wastes, and hazardous wastes. In the Southwestern United States, we are specifically concerned that there be no weakening of the "prevention of significant deterioration" provision of the Clean Air Act.

The Federal hazardous waste program was designed to address an issue of importance of all of us. However, the program was improperly designed by not considering the essential role of various agencies of local government such as police departments, fire departments, refuse departments, and environmental health departments. A serious gap remains at the local level where insufficient effort has been devoted to the essential roles of those personnel who may be first to know of hazardous waste problems, who may be first on the scene of spills, and who are the most likely to be contacted for information and results. The hazardous waste program should be redesigned to address the roles of local government and provide funding such as that currently granted to State agencies.

There also remains considerable confusion over the status of hazardous waste issues presumably being addressed under the Superfund program such as that in our own South Valley area.

It is regrettable that EPA noise pollution control programs have been dismantled. These programs should be reinstigated at the 1982 fiscal year funding level.

I recommend you consider that EPA design and distribute public information materials regarding 207–A and 207–B warranty provision to the end that automobile owners whose vehicles failed to pass the inspection maintenance tests are able to quickly and effectively take advantage of warranty provisions.

Small areas of our city and county were declared nonattainment areas for total suspended particulates. While you have notified us that there will be no sanctions imposed, we feel that a good-faith effort to solve these problems can only be pursued if EPA adopts a fine particulate standard so that we may effectively design control measures.

Funding for the federally mandated inspection maintenance program remains a problem. Requirements for a Federal fuel tax for nonattainment areas would be an equitable measure to cover the costs of federally mandated inspection maintenance programs.

I understand that Federal highway specifications for highway construction materials require dry screening, thereby creating a noticeable air pollution problem within that area. The possibility of wet screening for such materials in the arid Southwest should be reviewed.

We know that acid deposition is no longer considered to be confined to the Northeastern United States and Canada. Due to prevailing winds and locations of large smelters and powerplants, there must be continuing careful surveillance and research to prevent acid deposition in the Albuquerque area rather than resorting to expensive after-the-fact treatment.

Additionally, basic research efforts have been drastically curtailed. Research is an absolute necessity if we are to stay abreast of environmental problems and design effective measures to control such problems.

We recommend that EPA place additional emphasis on recycling, waste exchange, resource recovery, and process changes to eliminate the production of hazardous waste as alternatives to attempting to dispose of such wastes in secure hazardous waste landfills.

EPA technical publications should be readily available to the public and could be distributed through State and local environmental health offices.

We have serious concern about the continuing degradation of ground water supplies in the mid-Rio Grande area and sincerely invite increased research and EPA consultation to protect the quality of our limited and precious water resources.

Confusion continues over the programmatic coverage and definition of different wastes and chemicals under the hazardous waste program, the toxic chemical program, and requirements pertaining to oil spills. Obviously, the statutes and regulations should be redesigned to include all such hazardous wastes and chemicals under one program. When PCB's are not considered subject to the hazardous waste requirements, something is amiss.

We appreciate the support and consultation which EPA has offered on many occasions in the past. Most recently, EPA has provided funds for studying the brown cloud phenomena in this area, and I wish to take this opportunity to thank the responsible officials, including Senator Domenici, for his interest and role in gaining funds for this study. I know you will accept my comments as constructive and intended solely to provide local input for more effective environmental health measures for the citizens of Albuquerque and the mid-Rio Grande Valley of New Mexico.

Senator DOMENICI. Thank you very much, Bob. Your written statement was longer than you gave. I appreciate that. We will make your entire statement a part of the record.

In thinking back, Mr. Secretary, I think you excluded a few parts in the interest of brevity, and your statement will be made a part of the record.

I have a few questions. I think we are slightly behind schedule. I would like to ask the mayor, with reference to the innovative technology set-aside, you discussed, are you aware of any other major innovative projects that have been unfunded in the country that have some significant chance of moving the technology ahead?

Mayor KINNEY. The management advisory group for construction grants in EPA that I serve on has some other sludge handling innovative projects, but I do not know the particulars of them. I know sludge is even of greater concern to the eastern seaboard communities, but I do not specifically know what kind of project. I know that has been discussed in the past.

Senator DOMENICI. Are you a member of that group?

Mayor KINNEY. Yes, I am.

Senator DOMENICI. I wonder if you might ask them to send us further details. If we are going to shoot for some set-aside, we will have to know about more potential projects than irradiation, which you have discussed here. I would think there must be more.

Mayor KINNEY. Yes; also, there was recently a field trip to the Cincinnati facility on some of their innovative programs, and I think there is concern there. I agree that ought to be combined. Our concern by itself will not pull the weight. I will make sure that that is brought to your attention.

Senator DOMENICI. One last question for any of the three city witnesses, the president of the council, Larry, or yourself. Briefly, how is the inspection and maintenance program going?

Mr. GORDON. It's not going as well, Senator, as we had hoped or as public opinion polls would indicate. We are getting approximately 60 percent compliance with the program, which means that the council has had to subsidize it in order to keep it in operation, which I think really is inequitable for the council to have to do that. Because I think the cost should be borne by those that are creating the problem. I suppose that's the reason that the president of the council suggested a gasoline tax for those in a nonattainable area, because that would spread the cost equitably among the people that drive more or less and people that drive more cars, and so forth.

As far as its operation, it's operating smoothly, the testing is going well, and at this point it's a matter of improving the program, and getting better enforcement, and better compliance so we can get it up to a reasonable level.

Senator DOMENICI. Do you want to comment, Bob?

Mr. WHITE. I think Larry covered it reasonably well.

Mr. RUCKELSHAUS. Let me make an observation here. I don't have any questions. This is very helpful for me to hear from the officials right on the front lines as to what the problems are.

When I first came to EPA some 12½ years ago, I went around the country, in meetings similar to this, and talked to a number of State and local officials. And a theme I heard struck over and over again is that we are in this together, this is a partnership, we have all got to pull the same oar. And you have got to recognize that we are—all States and local governments have to fulfill.

These ideas were all embodied in the laws that have now been passed, starting in 1970 with the Clean Air Act, and all the other laws that, in effect, jointly administer, that deal with the environment. There is no doubt in my mind that these same things that were struck 12½ years ago are still here. The necessity of an honest partnership between the Federal Government and the State and local governments is just as real today as it was when we started this. And unless that partnership becomes effective, unless all levels of government are clearly assigned a role and are all pulling together, there is no way we are going to make it.

Whether this is exactly the design that any of us sitting here would have had in mind had we been in Senator Domenici's position or not is really irrelevant. We have been given that charge by the Congress, and it's up to all of us to pull together.

One thing that's clear to me that is terribly interruptive in the language of all these toxic dump sites, if there is a struggle between all the governments of the health effects, then the people that suffer are really the people that live around these dumps that become terribly concerned, become terribly frightened, and in a state of panic because the government seems to be pulling in several different directions at once.

I think the theme that has been struck here is altogether appropriate. It's the same theme I hear everywhere I go in the country. Namely, that we have got to have a partnership. EPA has got to be more sensitive to the problems from the State and local government. I hear this theme clearly from all of you gentlemen, and you can bet we will be responsive to your concerns.

Senator DOMENICI. Thank you very much. We appreciate your testimony. You are excused, and we will take the next panel: John Bartlit, chairman of the New Mexico Citizens for Clean Air and Water; Doc Weiler, vice president, governmental affairs, Association of Commerce and Industry of New Mexico; W. Paul Robinson, executive director, Southwest Research and Information Center; G. Stanley Crout, law offices of Stephenson, Carpenter, Crout, and Olmsted, uranium environmental subcommittee of the New Mexico Mining Association.

Witnesses, we are really going to have to hold to the rules as much as we can. So if you have lengthy statements, I would greatly appreciate it if you would abbreviate them to somewhere around 5 to 7½, 8 minutes.

Since it's consistent with our rules—your prepared written statements, will be included in the record in full. We will proceed in the order that I introduced you.

Dr. John Bartlit, I welcome you. If you would proceed, please.

STATEMENT OF JOHN BARTLIT, CHAIRMAN, NEW MEXICO CITIZENS FOR CLEAN AIR AND WATER

Dr. BARTLIT. My full credentials are attached to my testimony.

Although my testimony will deal with a range of different EPA related issues, if they contain a common thread, it is that there are gaps in the strategies for maintaining clean air and long-range visibility in New Mexico.

An essential tool for addressing visibility impacts of proposed new plants is a mathematical model for predicting impacts before the fact. EPA's official position is that none of the existing models for estimating visibility effects is acceptable. Yet, at the same time, EPA has halted all funding for research to develop an acceptable model. One or the other of these positions clearly must be changed if problems of future visibility degradation are to be addressed rationally.

State-contracted studies document clearly that the remaining unsolved air problem in the years ahead for New Mexico is NO_x emissions. Despite industrial growth, the application of abatement technology has very substantially reduced statewide emissions of SO_2 and particulates. However, due to the historical lack of effective abatement technology for NO_x, NO_x emissions have grown with industrial growth and continue to grow. In the future, the brown plumes of NO_x emissions from large industrial sources, especially coal-fired sources, can be expected to become increasingly familiar to New Mexicans as the overcovering emissions of SO_x and particulates are stripped away by abatement. Also, in the absence of requirements to use advanced technology like selective catalytic reduction [SCR], the expansion of electric power production will bump first against the ambient limits for NO_x. To remove this limitation, we urge EPA and Congress to move quickly to bring SCR processes into widespread use on new sources in our region. This could be done in the PSD permitting process or in technology demonstration projects.

New Mexico is preparing to take over from EPA implementation of its permit program for prevention of significant deterioration [PSD]. In fact, a State hearing on PSD rules will be held tomorrow. In view of the previously mentioned high value of long-range visibility in our region, this is a program critical to maintaining valuable economic resources of our State. To my mind, the use of best available control technology [BACT] as suggested in PSD regulations is, and always has been, the key to resolving conflicts between industrial and recreational uses of clean air.

However, the key is in achieving truly the best technology, or something reasonably close to the best. Present Federal and similar proposed State definitions of BACT are too loose to insure progress in employing BACT. The definitions say "BACT" means achieving the maximum degree of pollutant reduction achievable "taking into account energy, environmental, and economic impacts." We have no quarrel with including economic considerations, but the language is too vague. First, allowing both energy and economic considerations constitutes double counting. All energy impacts appear, and can be stated, as economic impacts. Whether it is energy consumed for control or an energy shortfall or disuse claimed due to control, the impact is economic or, if not, there is no justification for anybody caring about energy factors having no imaginable economic impact either now or later.

Second, and more importantly, what are the guidelines for taking into account economic impacts? Experience in other States tells us industry's idea of taking into account economics consists of pointing out the obvious fact that best controls—such as 95 percent sulfur removal on coal-fired powerplants—cost more than minimum controls—such as 70 percent SO_2 removal required to meet ambient standards and new source performance standards, perhaps identifying some million dollars cost difference between NSPS and BACT, and then seeking NSPS for BACT because of economic impact. Clearly this path makes a farce of, and eliminates, the concept of BACT in PSD rules. What is needed is something, some guideline, to which the cost difference must be compared. One suggested guideline is the cost difference—between NSPS and BACT—incurred in cases where true BACT was actually achieved elsewhere. EPA or Congress could help formulate such guidelines to make BACT meaningful and understandable to all.

As a result of aggressive litigation to avoid controls taken by polluters in the sawmill industry—Duke City Lumber Co.—and a succeeding, sympathetic court decision, the State's power of enforcement of clean air rules has become an awkward, nearly impotent aberration. The decision is this! On an appeal of a variance denial, an appellate court ruled a variance must be given the source unless a hazard to public health attributable to emissions from the source is established. The

EPA Administrator well knows the implications for enforcement from such distortion of normal procedures. Imagine, after hearings and appeals to establish ambient air standards, after hearings and appeals to establish emission regulations designed to meet those standards, and after substantiation by the State of source violations of those regulations and State and Federal standards, then the State must demonstrate uniquely a link between human health damage and the emissions from that source before clean air rules can be enforced. We seek help either from the Federal EPA or Congress to restore normal enforcement procedures to New Mexico.

The very substantial progress is reducing New Mexico air pollution has been won by hard and sustained efforts of the state, citizen environmental groups, volunteer contributors, pro bono legal help, and some companies.

Our relations with EPA throughout these 14 years of New Mexico actions and successes might best be described as uneven. The demeanor of EPA toward us has varied from helpful to solicitous, to condescending, to openly hostile in more recent years. On two occasions—issues with Arizona Public Service Co. and Molycorp—settlement agreements were reached among the State environmental agency, New Mexico Citizens for Clean Air and Water, the Rio Grande chapter of the Sierra Club, the polluting industry, and in one case, the U.S. attorney's office on behalf of EPA. Despite this broad support, these agreements encountered substantial reluctance and delay before getting EPA's approval, which in one case required for resolution a stated deadline from us by which NMCCA&W would announce suit against EPA for breach of contract. These difficulties spring more from inaction, inconsistency and constantly changing EPA personnel than from any irreconcilable differences of opinion between us.

For thoroughness, I will mention, without support, sundry other important air issues for New Mexico. The concept and adequate protection of integral vistas remains of high importance in helping protect our long-range visibility.

Although both of New Mexico's copper smelters are achieving or soon will achieve 90-plus percent control of SO_2, it remains critical to regionwide visibility to bring all Southwestern smelters under control without further extensions. Writing into the law now a fixed absolute deadline for smelter compliance would be appropriate to aid worker and company planning.

Acid rain studies should continue in the West, while sulfur emissions are held in check and work on NO_x emissions proceeds.

A limitation on New Mexico PSD rules set by the State legislature is the exemption from PSD of any source excluded from Federal PSD rules. This limitation presently excludes from PSD considerations two potentially significant, future sources—coal gasification plants and geothermal plants. Inclusion of these sources in the Federal list would solve the problem.

Thank you for coming to our State and for listening to our views. I would be happy to answer questions and provide more documentation on points critical to your deliberations.

Senator DOMENICI. Thank you very much, John. Let me ask you, with reference to PSD, you are speaking of the existing law, with reference to coal gasification and geothermal?

Dr. **Bartlit.** This would be State law which was passed by the New Mexico legislature this past session, added that restriction that we cannot cover by PSD rules anything not covered by Federal PSD rules. That was passed this last session.

Senator **Domenici.** My recollection is vague on how did we rule in our old law on what was included? Did we list it or did the regulators come up with a list. I don't remember.

Dr. **Bartlit.** I think it was in the act, I believe. I am not sure of that.

Mr. **Ruckelshaus.** If what you are doing is saying it was not included in the Federal standards, then the State cannot act.

Senator **Domenici.** What I was asking was, I don't recall us coming up with a big list when we did PSD back in the old act.

Dr. **Bartlit.** There was a big list.

Senator **Domenici.** I don't remember the list. There was, you think?

Dr. **Bartlit.** There is a list in the act, is my recollection.

Senator **Domenici.** I don't know why coal gasification would not be in. It should be in ours.

Dr. **Bartlit.** It's simply because there weren't any.

Senator **Domenici.** I think that's right.

Dr. **Bartlit.** And there aren't any here now, either, but there certainly could be.

Senator **Domenici.** I have a few questions, but I think we will move along and get back to you.

Doc Weiler, vice president of Governmental Affairs, Association of Commerce and Industry. We welcome you, Doc.

STATEMENT OF H. J. WEILER, VICE PRESIDENT, GOVERNMENTAL AFFAIRS, ASSOCIATION OF COMMERCE AND INDUSTRY OF NEW MEXICO

Mr. **Weiler.** Thank you, Senator.

The Association of Commerce and Industry of New Mexico is a nonprofit organization of more than 650 businesses located in the State of New Mexico. The membership is a cross section of all business entities in the State, ranging from the sole proprietorships to the largest corporations. Our purpose and our goal is to create and maintain an economic climate within New Mexico that provides the best opportunity for those for-profit entities in our State to be able to do just that—make a profit.

Among the areas of concern to us has been the approach by government at all levels, spurred by well meaning but sometimes myopic citizen pressures, to mandate certain requirements for clean air and other environmental areas, to be addressed by others, without any regard for their technical feasibility or their health-related benefits.

We have always believed that an individual State such as New Mexico can best legislate and regulate the entities within its boundaries. At the same time, we must recognize that regional concerns equally must be addressed. This requires Federal participation and is well recognized. We cannot agree, however, that a standard for our State should be the same as that for New York State. We are accustomed to large expanses of visible areas. To that extent the Clean Air Act addresses visibility protection, but we have a definite concern that there is a distinct possibility that EPA implementation of certain current regulations will substantially impede essential industrial activities outside of Federal class I areas while providing few demonstrable public benefits. Moreover, perceptions of visibility impairment vary significantly among individuals, as does visual acuity itself. Because no scientifically reliable means of measuring visibility currently exists, it is presently impossible to determine the extent to which visibility is actually impaired or improved. To segregate impairment caused by manmade emissions from that attributable to natural causes, such as dust storms, fog, and natural haze is a questionable process.

Further, based on 1977 amendments, the incorporation of integral vistas as a visibility concept, considerably expands the role of Federal land managers in setting visibility requirements which in our opinion was never intended by Congress.

The net result of the current visibility program as implemented by EPA is that new or existing facilities located near class I areas may be required to install expensive control technology to achieve nebulous benefits that cannot even be accurately quantified. Some facilities may be precluded, such as development of natural resources essential to national security.

We suggest a much better approach would be to apply such requirements to significantly impaired areas within congressionally designated class I locations.

The prevention of significant deterioration to protect class I and mandatory class I and class III areas presents significant problems to all of us.

Deterioration of air quality in these three classes of attainment areas is regulated through required adherence to specified PSD increments of ambient air quality standards for SO_2 and particulate matter. There are long and complex preconstruction reviews required for new sources or modifications in existing sources. Permits are issued or denied on the basis of this review. When granted a permit, the permittee is required to install the best available emission control technology [BACT].

All sources are required to complete 1 year of preconstruction monitoring and extensive modeling of air quality effects.

We believe these requirements have a substantial inhibiting effect on potential industrial growth. A study by Arthur Little & Co. shows that the increment approach is not directly linked to specific air-quality benefits. The study further indicates that utilization of alternative control techniques would be far more cost effective than the current increment approach and case-by-case technology determinations.

It is our judgment that the PSD program should be simplified and monitoring data given precedence over modeling information. If modeling techniques are to be used, they should be fully validated before acceptance. We also feel very strongly that the designation of class I areas should be an exclusive prerogative of Congress.

An exemption from class I and mandatory class II increments should be provided for strategically important energy and mineral mining activities. An exemption from PSD increments for fugitive dust generated by mining operations is necessary if any new mine development is to occur. Two recent modeling studies indicate that even small-to medium-size coal mines would not be able to show compliance with class II PSD increments unless harmless fugitive dust from mining is exempt or unless coarse particles are not regulated under EPA's NAAQS for particulate matter. The exemption should not in any way limit EPA's authority to redefine particulate matter for NAAQS or PSD purposes, and should apply to that portion of redefined particulate matter which meets the definition of fugitive dust.

The prevalence of harmless fugitive dust from mining and the limitations to siting new mines which must be developed where mineral deposits exist, irrespective of air quality designation, make sure an exemption is necessary. This problem is not unique to mining operations. Dust from farming operations, unpaved roads, road construction, as well as mining operations, is different from that emitted by stationary sources and is analogous to windblown dust in arid and semiarid areas.

Everyone is aware of the recent study completed by the National Academy of Science concerning acid rain. This phenomenon has become the focus of great scientific and public concern. It has been theorized that acid rain results from the oxidation of combustion products such as nitrous oxides [NO_X] and sulfur dioxide [SO_2].

The resultant adverse effects of this combination, in areas of heavy rainfall, such as the Northeastern United States has been an ecological impact that might well render fresh water ecosystems, without good buffering capacity, unable to support higher forms of aquatic life. I have not read the report, I alluded to above, but I believe it is fair to say that the concentration of such effects is primarily in the highly concentrated industrial areas of the Northeast and that the freshwater lakes there are receiving the greatest impact. I am unaware of any such effects on the waters of the mountainous regions of the West, and it certainly would be our recommendation that an independent study of the Western region be made before blanket percentage reduction regulations or legislation be adopted concerning sulfur dioxide emissions. Such a blanket reduction requirement would only lead to a dramatic increase in consumer costs for utility services in this region, which would result from high costs of control equipment installations. In effect, we would be subsdizing the coal mines of the East and adversely affecting sales of low-sulfur Western fuels. The percentage of sulfur content of Western coal averages about 0.66 percent dry, versus 2.5 percent to 3.0 percent of Eastern supplies. Ratepayers would of necessity pay these unneeded added costs.

Currently approximately 25 to 35 percent of per dollar investment costs of electrical generating plants is for environmental controls. This is reflected in about 18.6 cents per each dollar of ratepayers' cost for electricity. It has always been conceded that there is a public awareness of environmental needs and that such consciousness would face no resistance from the public in whatever costs were required. We have all been spectators at the recent forebearance of investment by home purchasers in refusing high interest rates attached to such an investment. We are dangerously close to such resistance in environmental costs.

There is no doubt that we Westerners are proud of our land and the beautiful and boundless views of mountains, mesas, valleys, and deserts. We wish to keep it that way, and at the same time are fully cognizant of the indisputable fact that the quality of life begins with a job. We are blessed with an abundance of natural resources. New

Mexico is a veritable energy storehouse. We are also capable of supplying the needs of our Nation with additional resources, beyond the energy fields, with our copper, molybdenum, potash, and agricultural products. Those of us connected with the productive industrial capacity of New Mexico believe that all of our environmental concerns can be met together with the furnishing of energy and other resources in a coexistent atmosphere. Neither one should be trampled upon by the other.

Regulations and legislation that goes beyond the bounds of need can destroy this balance and do irreparable harm. We need the industrial base to generate the revenue necessary to make the capital outlays required for environmental systems. We need to have watchful and concerned citizenry to monitor us so that in our zealous pursuit of one goal we do not destroy the other. That is our message to you, Mr. Director, and our esteemed Senator Domenici.

I wish to extend my thanks for this opportunity to be here today and will submit a detailed statement for the record within the 20-day period as required.

Senator DOMENICI. Thank you. We will keep the record open and look forward to your detailed remarks. Thank you very much.

Our next witness is W. Paul Robinson, director of the Southwest Research and Information Center.

STATEMENT OF WILLIAM PAUL ROBINSON, EXECUTIVE DIRECTOR, SOUTHWEST RESEARCH AND INFORMATION CENTER

Mr. ROBINSON. Thank you, Senator Domenici. Welcome to New Mexico. Mr. Ruckelshaus, I hope that you enjoy your stay.

I direct Southwest Research and Information Center, which is a small nonprofit scientific and educational organization working on a wide range of energy and environmental issues, and would like to address several of the issues which we have been working on in most detail, but would like to begin by discussing some of the national environmental matters which we, as New Mexicans, have a pretty strong feeling about.

The first, is the budget of EPA. EPA has been weakened substantially in the last 3 or 4 years, and the budget weakening results in both delays in schedules and the implementation of rulemaking and standard setting, but more critically in the areas of enforcement. And it's in both of these areas, standard setting and enforcement, where the New Mexico environment has fallen behind where we think a lot of other States have fallen behind as well. We certainly support the strength of the argument by the chairman of the budget committee about the increase in EPA's budget, but are concerned that the increases that are being talked about are going to put us at a level somewhere between the budget equivalent of 1972 EPA or the 1981 EPA.

We are not talking about meeting the goals that Congress has set forward. I think that what's being talked about is comparison to what could be worse budgets. I don't think that the environmental protection mandate responds to limiting the budget to previous years. It responds to the range of different statutory authorities that the agency has. With respect to those statutory authorities, as Bob McNeill says, many of the EPA acts are coming up for reauthorization in the upcoming congressional session. Certainly the Clean Water Act and the Clean Air Act, so major pieces of legislation which have a strong effect on New Mexico, and we think it's very important that they be maintained in substantially the same form that they are in.

We have had the delays, and budget cuts have weakened EPA's abilities to meet the limitations and the standards set forth by the Clean Water Act. Twelve years of litigation, I believe, has defined a very extensive and accountable water quality and air quality protection system. To go back and undercut that technical and legal administrative work by changing the rules before the goals have been met, I think would further delay the implementation of the clean water and clean air goals.

I think there is very little dispute on a national level in terms of some of the other legislation. The legislators are again, further behind in the rulemaking and enforcement aspects of those provisions. I think that a careful reading of those acts and a look at their track record indicates that there is improvement needed in terms of UMTRCA, and in terms of TSCA if we are going to be making progress on the rapidly growing hazardous waste problem in this country.

Another of the hazardous waste bills running through your office, no doubt, is the Superfund, and we are in a situation where the Superfund has been used to clean up less than 10 percent of the sites designated. Certainly none of those in New Mexico. And Americans though we are, many of us are New Mexicans first.

We also have found that some of the biggest hazardous waste sites designated by Superfund are uranium mill tailings sites. Millions of dozens of millions of tons of material are being distributed in stream beds. The lack of enforcement has allowed contamination to continue. Let's not forget that 418 sites designated for Superfund are known because they have already had contamination. We are not talking about a potential problem there, we are talking about existing problems worsening and growing rapidly more expensive.

The EPA has authority under the Nuclear Wastes Policy Act of 1982 to set standards for nuclear waste repositories in this country. Nuclear waste is an issue that my organization is concerned with, and various others in the state, and many want there to be progress on these nuclear waste matters. But universally, EPA is not sure if its standards are going to be applied to the major nuclear repository being built now in southeast New Mexico, the WIPP site. The EPA standards relate to geologic criteria for protection, as well as resource conflicts in terms of potential minerals and other values. New Mexico's WIPP site has few geologic barriers, and extensive potash above and oil and gas below.

We think that with the lack of an NRC license, or other regulatory standard, which the WIPP site will be measured by, we certainly think that the EPA Nuclear Waste Policy Act standards would be an appropriate set of criteria and would recommend that you make an effort to apply them to this major repository construction in the State.

As a final matter, I would like to mention uranium mill tailings. Uranium is an important mineral in this country. New Mexico is the most important uranium-producing State. We have over half of the reserves and over half of the existing production capacity. Unfortunately, universally, the uranium industry has fallen on bad times, and there is no more important place to look than in the handling of their waste. There are no reclaimed uranium mills or mines in the country. There are a number of very large piles, 3 over—20 million tons, much larger than the building we are sitting in, within 70 miles upstream as the radon flies, upwind of where we are now. And these are facilities which are becoming more and more expensive to both study, and certainly to accomplish remedial action.

This is an area where certainly the Senator and I have discussed in hearing as the regulatory has been defined, and we are in a position where EPA is, for the first time, putting forth standards in this uranium area. A number of other agencies, New Mexico's Environmental Improvement Division, as well as the NRC, have a great deal more of experience in terms of time and trial, both the tests and employing, to court aspects of the trial. And a lot of that wisdom appears not to have been factored in the analysis of mill tailings by the EPA.

Most noticeably in the failure to consider any health-based costs other than lung cancer deaths. There is a number of nonfatal symptoms associated with the radioactive and nonradioactive materials associated with uranium mill tailings that have been eliminated from the regulatory impact and environmental impact documents prepared by the Elm Street office.

Though my time is running away, I have been asked by a number of residents downstream of the Homestake site to read a letter to the committee.

> We are residents of Murray Acres and Broadview Acres Subdivision near Homestake Mining Company's tailings pile, Grants, New Mexico. We have prepared a statement which we would like to present to you at this time and ask it be made part of the record of these proceedings. I would like to read a brief summary of that statement to you.
>
> Understand, we are PRO-nuclear. Most of us are dependent one way or another on uranium production for our livelihood.
>
> In 1975, we were notified by New Mexico Environmental Improvement Division that we should no longer drink our water due to selenium and uranium contamination. We later learned the New Mexico Department of Health first notified Homestake Mining Company that they were contaminating the water in 1961.
>
> After twenty-two years, our water is badly contaminated. The EID said, "Don't raise a garden because green vegetables collect selenium." We are concerned about effects on our health now as well as in the future. We cannot drink our water, and we cannot sell our land.
>
> We feel that under these conditions, mill tailings' standards should not be lowered, but rather carefully evaluated to assure mismanagement of tailings' piles does not continue to occur.
>
> Senator Domenici, in a letter dated September 15, 1980, to Mr. and Mrs. Milton Head, you stated that "the safety and health of the residents of the area, as well as the integrity of the environment in the uranium mining area, is vitally important to myself as a legislator and also as a concerned New Mexican." Therefore, we would like to take this opportunity to invite you and this committee to come to Grants and view firsthand the problems associated with a mismanaged tailings pile.

Let me close by thanking you both for the opportunity to address these environmental questions and read the statement from the Homestake residents. I have additional comments, and, certainly, if there are any questions, I would enjoy responding. Thank you again.

Senator DOMENICI. Thank you very much. We will go next to G. Stanley Crout, law offices of Stephenson, Carpenter, Crout, and Olmsted.

STATEMENT OF G. STANLEY CROUT ON BEHALF OF THE URANIUM ENVIRONMENTAL SUBCOMMITTEE, NEW MEXICO MINING ASSOCIATION

Mr. CROUT. Senator, my name is Stanley Crout, and I am appearing on behalf of the uranium environmental subcommittee of the New Mexico Mining Association. I will summarize my statement because of the time.

Our great laboratories have played an important part in the investment of atomic energy. New Mexico has long produced about half of the Nation's uranium. The uranium industry has long been one of the most intensely regulated industries in the world. It is accustomed to regulation, and it has long been accepted that the investment of this mineral, which is a potential great benefit to mankind must be developed in a safe manner.

Even so, several recent proposals by the EPA have raised questions as to whether there is a possibility of viable domestic uranium industry in this country. It comes at the time when there is a great deal of economic depression in the industry, and the economic depression does not justify any lessening of a health standard or any lessening of an environmental problem. It does, however, preclude regulations which are necessary for health or environmental protection.

There are three recent EPA proposals that merit special consideration. One is the standards for uranium mills, both active and inactive.

The second is the application of Superfund to active uranium mills, and the third is proposed restrictions on radionuclides from mines.

EPA has now issued its proposed standards for active uranium mills. New Mexico has an especially important perspective in this regard, because in 1981 our environmental improvement board, with the advice and consent of the Radiation Technical Advisory Council, adopted very comprehensive regulations regarding stabilization of mill tailings. The New Mexico standards provide complete protection for public health at vastly less cost than those proposed by EPA. The Department of Energy generally favors New Mexico's approach, and I believe that the Nuclear Regulatory Commission will reach a similar conclusion.

There are two aspects of the EPA proposals that require special comment. Those two aspects are the portions of the regulations dealing with the amount of coverage or ground that must be placed over a tailings pile after the life of the mill is over and the pond is being stabilized. EPA proposes a randon fluctuation standard of approximately 20 pico curies per meter square per second. This will require approximately 10 feet of cover of dirt over the top of the tailings piles to accomplish it. The New Mexico standards, on the other hand, are roughly four or five times that, and they are measured at the property line, and it will require several feet of dirt, rather than 10 feet of dirt to accomplish this stabilization.

In terms of health results, the two are essentially the same. New Mexico's standards would—amount of cover required by New Mexico reduces the radon concentrations to levels that both EPA, NROS, and the New Mexico Environmental Improvement Board have been found to completely protect the public health.

EPA has attempted to justify its proposal on the basis of potential lung cancers in which they estimate that if all the tailings piles in the United States were left uncovered, you could have five potential lung cancer additions in the country. The basic assumption is wrong.

The tailing piles are not going to remain uncovered. New Mexico law requires them to be covered. Federal law requires them to be covered. So the basic concept of the five lung cancers is simply incorrect. Even if you assumed, however, that EPA was correct, that risk is actually pretty minuscule. It comes out to 1 lung cancer risk in 500—in 50 million per year, pardon me—in this country. Now, the risk of drinking 1 pint of milk per day is 1 in 100,000, or 500 times the risk that EPA proposes for mill tailings. If you drove a motor car, the risk of 1 death per year is 1 in 4,500 or 10,000 times.

Senator DOMENICI. If you do what?

Mr. CROUT. Drive an automobile. It's 10,000 times greater than any risk calculated by EPA for mill tailings. If you had a smallpox vaccination, the risk is about 1 in 330,000 deaths per year, or 12 times higher than EPA's proposal.

But, basically, what EPA goes on to do is say that once these sites are turned over to the Government, as they must be by law at the end of their active life, they are concerned not so much now about radon hazards, but about the misuse of tailings themselves for construction. That is, that after the companies deliver title to the tailings to the Federal Government, that should you—someone is going to get into this area and remove these tailings and use them in construction. Well, there is no history of this in New Mexico. And New Mexico maintains an enormous establishment to protect the Federal lands in New Mexico which are the majority of the lands in New Mexico. And we would submit that there is no risk at all once we have turned the tailings over to the Federal Government that someone is going to use it for construction. In fact, they even suggest that one of the damages is that someone is going to use the tailings for graveyards, which is really a preposterous suggestion.

Let's see what this would require. To accomplish EPA's proposal, the New Mexico Environmental Improvement Division has estimated that it's going to require 23,000 acres of New Mexico to be denuded to place the coverup on top of the tailings. That cost is approximately $200 million in New Mexico. And in addition, the risk of getting to the workers digging up the dirt to put it on top of the tailings and place it there is vastly higher than any possible increase in cancer caused by radon in tailings. In short, it's simply wrong to spend this much money on something that does not constitute a health risk.

It would be much better to spend it on health risk. It would be much better to spend this money feeding the people in this world who are starving. And it would be much better to spend this money on highway improvements where you could get some significant health results.

There is another aspect of the EPA regulations that deserves comment. That's on how they deal with discharges to ground water from uranium mills. Basically, the EPA approach is to provide no increases to concentration in ground water as a result of discharges from uranium mills. You look at the background upstream from the mill and, in essence, for many elements, no increasing concentration is allowed. And in other situations, a slight increase may be allowed. For example, selenium may go to 0.01, or less than one-half the amount of selenium contained in mother's milk.

New Mexico, on the other hand, has regulated ground water very intensely since 1977. New Mexico was the first State to adopt, and the first agency to adopt significant ground water standards. New Mexico has two really significant points to add to ground water regulation.

The first is, that you base the standards themselves on health considerations. That is, if we are going to use our ground water in New Mexico at all, which is most of our water, you have to allow increases in concentration flow as long as they do not create any health dangers.

The EPA has followed a different approach. They say no increase in concentration, regardless of whether it's a health danger or not. The EPA proposal on the uranium is 10,000 times less than the present NRC standards for discharges of uranium to water. And there is just no health justification for that.

The other factor that EPA does here that deserves consideration is this. EPA measures concentrations at the toe of the tailings pond; whereas, New Mexico measures concentration in ground water at the place where it is used, or will be used, by well. And in ground water this is important, because it does not have any environmental effects unless it is pulled from the ground to come into contact with humans or animals. And this is important, because most of the minerals associated with the uranium industry, as they seep through the ground from the tailings pond, are absorbed into the soil itself. This is a very natural process that occurs. In fact, that's probably how the uranium was deposited in New Mexico in the first place. EPA simply measures it at a different point and eliminates the techniques of absorportion and dilution that has been used by the New Mexico uranium industry successfully for a number of years.

Senator DOMENICI. How do you know in advance from where they are going to take the water?

Mr. CROUT. In New Mexico what we do is this. If the company owns the property itself, and puts legal restrictive covenants on it, then, of course, you know it can't be used there. In addition to that, the company often gets restrictive covenants on property it does own, provided that no well will be drilled there. So you go through the same procedures you generally go through, say, on any real estate transaction, like restrictive covenants in a subdivision. You can do that. In addition, you can introduce in some cases scientific evidence, if there is no ground water there in the first place, so it won't be used. It's a pretty well accepted procedure in New Mexico, and we go through it with the EID on a regular basis and introduce evidence.

Senator DOMENICI. Are you almost finished?

Mr. CROUT. Yes, I have one short comment. I think probably the major difficulty that's occurring in New Mexico, perhaps nationwide, with our environmental laws is this. That we are spending a tremendous amount of effort and talent arguing about the liability of who is going to pay for certain environmental techniques. What we are ignoring is what should be done for the national interest.

Usually the situation arises when we have a facility that was built under one set of laws come under a new set of laws that are more restrictive or different in their applications. And it's inequitable to look to the countries to resolve these type of problems from their own pocketbook. These are national problems created by national laws, and they need to be foused on from a national fashion.

The example that comes to mind is, when I was a child here, that you could see the great dust storms coming out of Oklahoma, Kansas, and west Texas. That was created by a dust bowl that was created in a large part by misusing the land in farming techniques. We did not try, in those days, to say, OK, each farmer you pay for the correction of that. What we did was approach that from a national point of view. Let's solve a problem, it's a national problem and we have to get it done. If we do that, a great number of the controversies in this area will be solved, and we will all be better off.

Senator DOMENICI. Let me just suggest on your last point, I haven't thought that through in its entirety, but we did, as a Nation, move in that direction to some extent because maybe we were forced to by virtue of no other way. But as far as abandoned mill-tailing sites, we assumed the responsibility to pay for that nationally. We haven't made much headway in 10 years, but at least the sites are out there, 22 or 23.

Mr. ROBINSON. Twenty-six.

Senator DOMENICI. Twenty-six; the Government will pay for those. You are suggesting that perhaps as to the active tailing sites that maybe the Government ought to pay for part of that?

Mr. CROUT. Yes, Senator. In fact, Congress passed a law, as you might recall, on the commingled sites where they were generated, in part, for the national defense program. And, for example, EPA has moved, under the Superfund, to require the company to spend the money. We pointed out that the Federal Government owes for that, because at least tailings were generated, or at least part of it, and EPA says, No, that's some other agency of the Government. I think that's a situation where Congress can correct by simply providing that the court of claims has jurisdiction to determine what share of those commingled tailings the Federal Government should pay. That's legislation that's certainly needed in this industry.

Senator DOMENICI. I would add to my original remarks, we did attempt in some commingled sites to place some of the responsibility on the Federal Government, but they are not all inactive. I understand that.

Let me ask you one question, and we will go on. With reference to EPA's standards that you are addressing as they pertain to mill-site stabilization, as I interpret the present law, the effect of that will not be conclusive on New Mexico, because New Mexico has the flexibility under the existing law to provide to the Nuclear Regulatory Commission, as an agreement State, its alternative plan. And the language is quite clear that alternative actually means that they can have a different approach as long as it meets the same standard. Do you understand the law to be that way?

Mr. CROUT. Exactly, Senator. But the experience we had with NRC is exactly that there is no question—when it came up before in 1981 and 1982, that under the administration of NRC at that time, there was no question that NRC interpreted that law differently than I feel certainly would have rejected the New Mexico regulations had it not been for the acts of Congress and for the acts of the 10th circuit court of appeals.

Senator DOMENICI. I don't see how they could have a different interpretation under the last law. Nonetheless, you could still give an answer that they could have what you consider, or what society considers, to be appropriate standards, that they apply it somewhere. Where it's not an agreement, state it elsewhere.

STATEMENT OF JAY B. SORENSON, SIERRA CLUB

Dr. SORENSON. I am Jay B. Sorenson, a representative of the Sierra Club. I am the former chairperson of the EPA/Albuquerque Citizen Advisory Committee on the irradiated treatment of sludge. I have been a member of the State's water quality control commission, and a member of the Department of the Interior's task force on uranium mining and milling in San Juan regional basin. I am presently heading up a small working group of scientists to review the State's radiation regulations for the Governor. I am also a member of the American Lung Society of New Mexico's Air Quality Committee.

I am a University of New Mexico professor of political science, teach courses on the environment, and have written on the acceptability of risks. In this regard, I have helped to design an environment, safety, and health assurance standard for DOE and its contractors. It is being field tested, and, so far, contributed to a one-third drop in the occupational accident and injury rates. It is being applied by a number of major national firms as well. I will say more about this assurance standard later.

On behalf of the environmental community, I should like to express our appreciation to the two of you for this hearing in New Mexico. We know that we have to win your support, and I hope that these remarks, along with Secretary McNeill's, John Bartlit's, and Paul Robinson's, will convince you of the wisdom of our position and the need for rigorous protection of the environment and public health, nationally and in New Mexico.

We have major environment, safety, and health concerns in New Mexico that are related to EPA's mission.

New Mexico is more fortunate than most States, for it is still in the relatively early stages of industrial development. This means if we act with determination now, there is still time to prevent much pollution and to protect an environment of superior quality—far better than in other parts of the Nation.

To convey our concern, let me offer a gross evaluation of our environmental quality.

It is largely based on a Quality of Environment Index designed by the National Wildlife Federation. It presents an evaluation of environmental quality by comparing today with that of a decade ago on a simple scale of the "same," "better," or "worse." It also offers insights into the problems of the future.

The results I am presenting do represent the observations of some of the State's environmental managers, lay people, and concerned citizens, and it reflects work, I and two others, have just completed for the State's secretary of health and environment. Since others have dealt with our environmental concerns, I will discuss water, my area of interest, more than air, land, et cetera.

With regard to the evaluations, the findings indicate that with regard to air, progress continues, but on the index the overall perception of air quality is not as good as it used to be. The State law that was approved by the Dallas EPA office flies in the face of the Clean Water Act. Its justification in terms of the western doctrine of beneficial use is not persuasive. It is an outstanding example of poor institutional water management, and it sorely needs to be corrected. And this, to a certain extent, represents the overall profile. It indicates, really, that we are barely holding our own with the environmental regulations that are on the books.

Given the stress that we can expect in the future, we are going to need much more stringent and diligent activity.

We have an agenda, and I would like to deal quickly with some of the points with regard to water and what was said in the U.S. Senate last week. We feel that the basic concessions have been made. We urge that—since this is regarded as a separate issue, the Senate and EPA not allow slippage in the effort to control this very controversial source of water contamination. The bottom line for us is who decides. And I can't think of a more important problem. Who lives? Who dies? and Who decides?

It's a speech that Secretary McNeill referred to where you call for a new alliance between government and the scientific community to better assess dangers of cancer-causing materials. We agree with all this, and we appreciate a number of points that appear to be in your speech. The fact that you did not downplay health concerns, that you stressed public participation, and the fact that you called upon the public to assist in evaluation of the risks.

We also agree with you that EPA's present problems reflect many of the political considerations that were interjected into the consideration of these risk concerns. We do, however, have some concerns.

One of them reported your belief that we should have a single assessment for the evaluation of risk, and we believe that some controversies between different agencies can serve the public well, and would call to mind the conflict between the agency and Public Health Service over the effects of radiation, and the progress we have made as a result of that conflict.

You suggested that this is very difficult to establish, and we agree. But you also tended to indicate that a cost-benefit analysis might be the better way to go. We would take strong exception to this, and would hope that this would not be the case. We see environmental risks to be involuntary risks. They are imposed on people, and they are nonexcludable—there is no choice. We very much believe that the measure is not to be a cost-benefit of measure but to be really a health measure.

In this regard, we would like to call your attention, really, to the possibility of working from a de minimis risk criteria; in other words, a criteria which would hold the environmental health risks, risks that are imposed upon the public, over which they have no choice and no control to be held to so minute a level that they are relatively harmless to man and his environment. We also believe that this is a better way to go since we will not have the quantitative and qualitative information for the long-term periods, in other words, since it will not really be adequate for providing us the information and the data that we need. And we need a standard and a de minimis standard as an effective way to go.

We don't believe zero risk is possible. We do believe there must be sore risk. However, for us the bottom line is not the determination of the acceptability of the risk, or other the assessment of the risk, but it is really the assurance of acceptability of the risk. In other words, there is a price of confidence in the country. Because of that, the country is having great difficulty accepting these voluntary imposed risks and standards that are being offered by the Government and industry.

Essentially what we need is to be able to assure the public that the risks they have to accept, the involuntary risks are based on levels of protection that prudent people and reasonable people would judge to be low and acceptable.

In many respects this is the very basis developed and field tested by the Department of Energy and its contractors. In its elemental form, it calls for all significant hazards to be identified, adequate assurances for their control must be known, change in factors that would increase danger must be controlled, emergencies must be prepared for and tested in reliable ways, and independently verified. It eventually pegs the risk standards to the acceptance of those at-risk and assures that the level of protection is adequate.

I would like to close by offering this as a constructive proposal that could possibly help solve a problem that all of us need solved in a mutually acceptable way. Thank you.

Senator DOMENICI. Thank you very much, Jay. Our last witness on this panel is Harry Storey of the Western Regional Council. Mr. Storey.

STATEMENT OF HARRY L. STOREY, CHAIRMAN, CLEAN AIR AD HOC COMMITTEE, WESTERN REGIONAL COUNCIL

Mr. STOREY. Thank you, Senator.

I am Harry L. Storey, director of industry and legislative issues for Anaconda Minerals, a subsidiary of the Atlantic Richfield Co. I appear before you today on behalf of the Western Regional Council and as the chairman of the WRC's clean air ad hoc committee.

Let me say that we have prepared and submitted to you a detailed statement which I would respectfully request that your place in the records. And I might also put you at ease in that we had a first-place presentation which was 15 minutes, and now since we are in seventh place, we will give you the 5-minute one.

The Western Regional Council appreciates the opportunity to participate in this hearing. The Western Regional Council has been particularly active in two issues, the clean air and the clean water issues. We have worked aggressively over the years, both with the Congress and with the administration, on these clean air and clean water issues we believe uniquely impact the West.

I will first share with you our concerns and issues in regards to the Clean Air Act, and then I will move on to the Clean Water Act.

The WRC supports legislative efforts to reauthorize the Clean Air Act and is hopeful for action yet this Congress. We are hopeful, too, that the new EPA Administrator will be an active, positive, and encouraging force toward that end.

As business people who live and work in the West, we in the WRC support the Clean Air Act's goals and intent and what it can mean for the western quality of life. We, therefore, advocate stringent protection of our pristine areas, the national parks and the wilderness areas, and we do not seek changes in the act which we feel would contribute to overall deterioration of air quality in our States. We are concerned, though, too, with specific provisions of the act and with current legislative proposals which we believe go beyond prudent efforts to improve air quality, cause unnecessary adverse economic impacts, and in some cases, abuse the intent of the Clean Air Act to accomplish other purposes.

Let me briefly review our positions.

Under prevention of significant deterioration, the WRC recommends the retention of the most stringent PSD requirements, those for class I areas, but we believe that the short-term increments should be eliminated. We recommend dropping class II and III designations, but retention of BACT as an integral part of the PSD program, to assure that new sources will utilize the best pollution control equipment available for each pollutant.

The visibility issue is a very important one to the WRC and has its greatest impact in the West. We oppose the integral vista concept. It is not a part of the act and it would extend Federal jurisdiction far outside the boundaries of class I areas, frustrating State, local, and private land use and siting decisionmaking roles. We believe the language adopted by the Senate committee last year would create an unworkable situation in which the State would find itself with an impossible burden of proof in determining an overriding public interest in siting a facility. We strongly support attempts to remove this language and hope to work with the administration toward finding more workable approaches on the visibility issue.

On fugitive dust, we agree with the attempt by the committee to provide an exemption for large, nonrespirable, nontoxic particulate, but would hope the committee this year could better clarify in legislative language the phrase "uncontaminated soils." Potential problems involving dust from haul roads and mining-related activities prompted our work for a fugitive dust exemption. Language currently in the bill might preclude its application to those activities.

We are opposed to the percentage reduction requirement under NSPS. We realize the difficulty this issue has caused for the Senate committee, and we are grateful for the efforts of Senator Domenici with Senator Simpson to change the provision. We continue to believe that sources should be allowed to meet emission limits through the most cost-effective means available. To force costly scrubbing when less expensive methods of emission reductions are available, subverts the purposes of the act to regional economic protectionism. We realize that Western Governors do not want to lose advances made in the West in reducing emissions resulting from percentage reduction. However, we would urge the Congress to eliminate the percentage reduction requirement and debate the real issue of emmission levels.

The WRC supports the Domenici amendment included in the Senate committee bill, S. 768, to section 117 of the act to provide continued flexibility for nonferrous smelters to use supplementary control systems under limited conditions and for the issuance of nonferrous smelter orders to 1993. The Nation's domestic copper industry is in serious financial jeopardy. If this provision is not included, the Southwest in particular will have massive layoffs and our Nation will become dependent upon foreign sources for its copper.

The WRC opposes the interstate pollution amendments now contained in the Senate committee bill. The proposed amendments would transform the current narrow, precisely defined system of appeal, with the EPA Administrator acting as a mediator, into one that is extremely open-ended. The amendment would permit any citizen, instead of one State pursuing another State to take action against any alleged source or group of sources on interstate pollution through the Federal district court. The amendment would enable such action against almost any level or kind of pollution, notwithstanding existing concepts of specified air quality standards or criteria pollutants. These amendments, if left intact, could conceivably shift to the courts a parallel system of air pollution control taking from the Congress and the EPA their appropriate responsibilities.

The Western Regional Council has for some time had a position on the issue of acid rain. New information and new legislative proposals are moving quickly on this issue, and we are reviewing our position in light of those developments. Our new acid rain position is not yet finalized by our organization, but I do want to share with you our basic concerns.

First, I want to point out that we recognize the level of public interest in the acid rain issue and the strong commitment several Members of Congress have made to adopt acid rain control legislation. While the problem deserves careful attention, it would be unfortunate if it were to deprive other important clean air issues of the thorough consideration they also deserve.

Although there remain many fundamental questions surrounding the causes and effects of acid precipitation, scientific reports have been released in the past few weeks which are more conclusive about the nature of acid rain and the relationship between it and emissions. Those reports also reinforce the regional nature of the problem as now understood.

To date, research in the Western States has been much more modest than that in the East, but it has not identified serious acid precipitation problems such as exist in the Northeast. A number of factors may account for that difference. There are fewer coal-fired powerplants in the West, and they are widely dispersed. Furthermore, they are subject to stringent emission limitations and use low sulphur coal. Less than one-tenth of the sulfur dioxide emissions produced by coal-fired plants in the United States is generated in the West. In the West, we have a drier climate, allowing less acid formation in the atmosphere. Also, most of the West has a typically alkaline soil which provides natural buffering capacity with respect to acidic reactions.

We in the WRC believe that if Congress legislates to improve controls to reduce acid precipitation, that regional variations and State flexibility be taken into account. Initial emission controls should be applied to mobile and stationary sources in regions where significant acid precipitation problems exist. We will continue to advocate accelerated research to better understand the phenomenon and believe that emission reduction requirements should be implemented in a program of several phases as more is understood. Research results should be the basis upon which control measures are designed.

Overall costs of reductions in emissions to reduce acid precipitation are estimated in the billions of dollars. To the extent that controls are phased corresponding to research results and to the extent that sources are permitted flexibility in achieving reductions, the costs can be minimized. Major initial reductions can be achieved without the installation of costly technological controls. We will oppose efforts to spread the cost of initial reduction. Coal-fired plants in the West have already been required to install technological controls. These controls were imposed despite the relative low-emission levels in the region. And those costs were borne by the utilities and you, the consumers. We see no equity emission reductions beyond the individual polluters.

Finally, we suggest that if a cap on emissions is included in the legislation, that it should reflect the allowable emission levels at the time of enactment. I would like to advise——

Senator DOMENICI. What does that mean?

Mr. STOREY. Senator, it is our position that if we have an acid rain bill, and a—particularly 48-State acid rain bill, we would have a cap on the emissions of, for instance, powerplants of the date of the enactment of the acid rain legislation.

I would like to address, very briefly, five areas, or the areas in the Clean Water Act, which WRC opposes and, if needed, the amendment. Attached to our statement is specific amendment language which we are proposing on these areas, regulates discharges from point sources which are generally defined as discrete conveyances such as pipes. EPA has interpreted "point source" to be devices which divert storm water runoff or snowmelt. As a consequence, these mining and our industrial facilities that have constructed diversion facilities to prevent storm water or snowmelt from contact with process areas and toxic materials, are often required to obtain an NPDES permit requiring them to treat these waters. If discharges are contaminated, they are covered elsewhere in the act.

The WRC recommends that devices that merely divert or gather and collect storm runoff and snowmelt without adding to their contamination should not be considered "point source" subject to EPA regulations.

It is the goal of the act that the discharge of pollutants into navigable waters be eliminated by 1983. Congress only intended the zero discharging to be a target. Regulatory bodies are interpreting the goal literally to mean that all discharges, including reclaimed water from industrial and agricultural use, must be eliminated by 1985, regardless of quality.

In the intermountain West, water basin compacts and surface water adjudications have been based on historical flows. However, as a result of the zero discharge goal, as interpreted by State and Federal agencies, States could be compelled to abandon water rights. Relative to water quality concerns, States are again compelled to encourage consumptive use.

In the intermountain West, downstream water availability relies heavily on the return flows. The Clean Water Act's section 101(g) states that this act shall not supersede or abrogate State water rights. The WRC recommends strengthening this position so that the Clean

Water Act will no longer be in conflict with the Western States' water law.

Dischargers required to install treatment technology that is better than BAT should be given an opportunity to show that advance treatment is economically unreasonable. Current Federal law does not insure that discharges have this opportunity. Our written statement provides our concerns and remarks to the Senate committee actions on this issue in some detail. And I would hope that you and your staff might have time to review it.

As a Senate Subcommittee on Environmental Pollution marked up its amendments to the act, we were happy to see section 302–8 of the Clean Water Act was amended to allow States to initiate consideration of economic forces before any water quality-related effluents limitations were imposed on a discharger. This amendment, to our disappointment, has now been deleted.

The WRC has met twice with EPA staff in the past year to discuss our amendments to the Clean Water Act and Western concerns on the water quality standards. We would hope that the EPA will continue to review this area, and that the Senate will also reconsider its position in this regard.

Our written statement provides more details and information on our concerns and impacts in section 404 in the semiarid West. We have made recommendations for congressional action and hope that they will be considered.

Again, on behalf of the Western Regional Council, let me express our appreciation for the opportunity to participate in this hearing.

Senator Domenici. I thank you very much, Mr. Storey, for your testimony. We have one more group. But I think maybe we ought to take a little bit of time to ask a couple of questions. If we have some written questions, we will get them to you, and if you can answer them in 10, 15 days, it would be most appreciated.

Let me just ask John a couple. About that Creston Powerplant in Washington, I understand your concern with reference to the bill that was reported last year, which is not law, obviously, but will be the framework for discussion of a new Clean Air Act.

You indicated that Creston Powerplant was an example of how the BACT process and the use of economic data—I think you used it as an example——

Mr. Bartlit. Let me clarify that a little bit. To my knowledge, that final decision has not been made. The final decision at Creston will have to be by the EPA, and has not been made. I am referring there mainly to the industry's position, and it has gone through several phases of modest acception and modest rejection by most State and Federal agencies, but the final decision has not been made.

Senator Domenici. Because my recollection is, while we were debating that we received a list of all the BACT decisions in the West, since the imposition of PSD, I think it was the environmental defense fund that gave us the list. And those decisions ranged from about 85 to 95 percent control.

Mr. Bartlit. That's correct.

Senator Domenici. Which were arrived at in the same manner by the same process that Creston started at, 70.

Mr. Bartlit. Yes.

Senator **Domenici.** So I would assume that the way we are defining it, the 85 to 95, would end up being BACT.

Mr. **Bartlit.** If that were to end up at BACT, 95 percent, that is BACT then, I think, and that would be fine, and a lot of progress.

The problem is that the present law gives an awful lot of leeway, and there is an awful lot of argument, and there is an awful lot of environmental groups taking an awful lot of legal funds, going to a lot of courts, making it come out the way it comes out. I am not saying we have no tools to work with, but to have an unnecessary hassle over those economic factors in each and every case is a great burden. And I agree with your former position that 85 to 95 is indeed bad.

I would also make the comment that the BACT decisions on other than sulphur dioxide are not as good as they are in sulphur dioxide. They are much closer to NSPS.

Senator **Domenici.** Let me just tell the New Mexicans that are here of the difficult problem we are going to have whenever we draw a new Clean Air Act as it relates to PSD.

I think you know that the present PSD program which the State has now told us they are going to begin hearings to assume the responsibilities to implement the present law, and we have to write a new one. In the intervening time, we have had a National Commission on Air Quality meet. They took—I don't remember how long—perhaps you remember, John.

Mr. **Bartlit.** It was 1½ or 2 years.

Senator **Domenici.** The Chairman of that Commission, made up of citizens and legislators from the House and Senate, concluded, with reference to PSD, that it was too complicated in its present form to be the kind of tool we ought to have for preservation of pristine areas, and recommended that we abandon everything but class I areas. There was also some language with reference to BACT taking the place of class II and III. I hope everyone understands that there is a very strong momentum to modify that law to make it easier to implement, and there is strong polarization in terms of getting rid of class II areas in their entirety and going to the recommendation of the national commission.

So the job isn't easy. It's a different problem in New Mexico than other States. We did come up with a compromise that was principally mine. It has satisfied no one, but it's still in the draft. And we do have class II's protected. We do have a regional BACT concept. We don't have the total presumption that some would like in terms of what BACT is, other than it's a challengeable situation. And we have the States being required, within a reasonable time, to come up with a comprehensive plan with reference to PSD.

I hope we will continue to dialog, because I know this will be one of the most difficult problems we will have in the Clean Air Act. And I would say publically that John Bartlit, and those who relate through him, has been most constructive and most helpful as we have gone through it. And I can commit to spending as much time as necessary on that bill when it gets back to the committee. If it's this year, we will find the time. If it's next year, we will find the time. I really don't know the strategy yet, other than one thing. I don't think the Senate is going to report out a bill for the new Clean Air Act for the country unless and until we are satisfied that the U.S. House is also going to report out a bill. We aren't going to go through the whole thing in 2 weeks on the floor to find Congress—the whole 2 years—is up, and we have to start over again. Maybe if we push, the House will make a decision.

But they are entangled in much more parochial problems centering around auto emissions, and Chairman John Dingell. I think it will be both Houses sitting down and deciding whether they want to get a bill done or not.

Bill, I certainly welcome any observations or questions you might have.

Mr. **Ruckelshaus**. You might be happy to know, Senator, the House has informed me that they are not going to report out a bill until they are confident you are.

These presentations raise 20 questions in my mind, each one of them. And, obviously, we don't have time to address all of them.

Let me make, as I did at the conclusion of the other panels, one or two observations.

It is clear from listening to the panel that the problem of pollution is very much in the eyes of the beholder. The speech which now has been referred to twice in this testimony that I made about a week ago to the National Academy of Science was an effort to try to simplify our national approach to dealing with the problems of pollution, and the problems with the protection of public health.

I suggested that we divide the issue of risk assessment, or what is the nature of the problem we are trying to deal with, and separate that from risk management, or the question of what we ought to do about it. Too often—I think at the Federal level, I think we have confused those two issues. We have confused the question of what is the nature of the risk we are trying to protect ourselves against, from the question of what we ought to do about it. And when we confuse those two things, we confuse people.

After all, the foundation of our laws in this country, and the foundation of any effective pollution abatement program, depends on the support of the people. And unless we take this question of how we assess risk, what the risk is we are trying to protect people against, and separate it from the question of what we ought to do about it, the policy that should flow as a result of that assessment, we are going to continue to confuse people.

I would be interested in pursuing with Mr. Sorenson his standard of de minimus risk as one that should guide national policy.

My own belief is, in addition to the risk assessment, we need to assess carefully the nature of the cost, the people that are affected, what populations they are, whether they are voluntary or involuntary recipients of different kinds of pollution. There are all kinds of ways of attempting to describe what we ought to do about managing risk. In fact, written in our laws and regulations are every conceivable ways of assessing management risk that man can conceive of. This is one of the problems I think we are having in coming to grips with pollution problems, in general, and understanding exactly what ought to be done about them.

I think if we could get a common framework from which we can both assess and describe how to manage risk, we would be better able to come to grips with some of these problems in a more understandable way.

I also can't help but comment on the question of who pays for all this. We have heard from both Mr. Crout and Mr. Storey suggestions at to who ought to pay for problems of uranium mill tailings.

In the case of Mr. Crout, and because of acid rain, and Mr. Storey, one suggested the national taxpayer should pay. The other suggests the consumer should pay. I suggest those are the two groups we are talking about, and very different things flow from which group you decide should pay. We sometimes think that, "Well, we will load it on industry, they are the ones that are causing the problem." It's the consumer who is going to pay for it. Assuming the industry can pass it on, and there aren't any statutes for the products they are going to make, then they are out of business. But they pass all those costs on. They can't absorb them themselves. They can't stay in business otherwise. It's either the consumer or the taxpayer that pays.

Acid rain is right in the middle of that. Who pays for it? There is no doubt that the recent studies of the National Academy of the studies made by the science advisory to the President have shown that there is a problem. We don't know how fast it's accelerating. We don't know what the trends are. The major source of that problem is manmade. We can't tell you where those manmade problems are.

We can take the 31 States around the Mississippi, and if you cut those 31 States, on an average, you could also cut acid precipitation by 50 percent. That does not mean you would cut it by 50 percent in those areas more vulnerable. You might cut it by 30 or 70. If you cut every industry by 2 percent, you could cut acid precipitation associated with SO_2 by 50 percent. That's an expensive approach. How much benefit we would get from that is still a scientific debate.

But the question before Senator Domenici and the Members of Congress is going to be who pays for it. If we decide to go to a very large reduction or a massive reduction, you can bet the arguments that are going to be spread across the whole country are going to be fierce.

The utilities in the Midwest that are going to be dramatically affected by those reductions are going to resist very hard. They are going to say the taxpayers are going to pay for it—that's the consumer or the taxpayer. Those decisions are difficult. And they haven't gotten any easier since I left EPA.

And I think what we have heard this afternoon will demonstrate the complexity of these issues and the difficulty in coming to grips with them. But I think we simply have to begin to face them head-on. And I hope they can be faced as unemotionally as they have been presented here to me and Pete Domenici this afternoon.

Senator DOMENICI. I would say, Mr. Administrator, that the issue of acid rain and who pays for it is not far away, as some of you already know. I am not going to ask any of you now, although I may submit it in questions, what you think about the Waxman bill. But, basically, it is not precisely what the bill said, it is not 50 percent, but it has millions of tons reductions with a number, and it would spread the cost of that to all the electric users in the country on a millage rate to go into a national fund to pay for the cost of retrofitting and reduction. And the House will have it first. I don't know of any similar bill in the Senate, but I would think that it would probably—if these kinds of proposals follow suit—it will find its way into the Senate shortly as a debatable issue. And that's very difficult, not only from the standpoint of consumers nationwide paying it, but it continues to have some kind of a coloration of protecting high-sulfur Eastern coal uses and Midwestern coal uses, to the detriment of cleaner coal. That isn't its total purpose, but as a result of that, it will have a rather quick nucleus of support. It seems to me, if you live in one of those States, you obviously would rather have the rest of the country pay for it. So there will be rather a significant collision rather quickly.

With that, we will excuse the witnesses.

[Thereupon, a recess was held.]

Senator Domenici. Could we have order, please? We are going to proceed now with our last panel.

Before we do that, I have been requested to insert in the record the State senate's joint memorial 15 supporting the regulations of the Environmental Improvement Board in regard to the uranium mill tailings, and a resolution of the New Mexico Radioactive Materials Committee of the New Mexico Legislature dated and adopted on June 23, 1983. And we will make those a part of the record. [See pp. 64–78.]

We welcome the witnesses. Ronald Cummings, president of the Department of Economics, University of New Mexico. Dr. Bernard Zak, supervisor of the Applied Atmospheric Research Division at Sandia National Lab. Dr. John Hawley, Dr. Charles Kolstad, Economics Group, Los Alamos National Labs. Dr. Joseph Mauderly, senior scientist, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute. Dr. Harold A. O'Brien, chairman, New Mexico Radiation Technical Advisory Council.

Let's us proceed with Dr. Cummings first. We welcome all of you. Dr. Cummings.

STATEMENT OF RONALD G. CUMMINGS, PROFESSOR OF ECONOMICS, UNIVERSITY OF NEW MEXICO

Dr. Cummings. I would like to preface my remarks with a "Welcome to New Mexico" to Mr. Ruckelshaus and committee members. I hope that our hard-driving Senator Pete will allow you a bit of free time so that you might have a chance to experience some of the enchantment offered by our beautiful State.

My brief remarks will focus on an environmental issue that is of growing concern to New Mexicans: the generation, transportation, and disposal of toxic materials. In terms of the disposal of toxic materials, we are all aware of the lethal legacy of long-past methods used in dumping hazardous materials in landfills or simply on the ground; ground water contamination in Albuquerque's South Valley is a stark reminder of that legacy. We are also aware of the complexities and costs associated with removing, or mitigating, effects from contaminants once the damage has been done.

In this period of fiscal austerity, this committee, and Mr. Ruckelshaus' agency may have questions as to the degree of vigor—and costs—that should be applied to efforts designed to monitor and control the multitude of toxic materials produced each year in our economy. You may be encouraged in these regards by results from research recently completed by my colleagues and I. This research was designed to measure, first, the extent to which people are aware of the existing state of environmental regulations imposed by the Federal Government as well as what they now pay for the benefits of those regulations—payment in terms of higher taxes and higher prices for goods and services; and second, individuals' willingness to pay for still more improvements in the environment particularly for more stringent controls on the management and disposal of toxic materials.

Senator DOMENICI. Excuse me. That means you are equating benefits with that which they seem to be willing to pay?

Dr. CUMMINGS. That's true. Without going into the many caveats related to the precision of results from this experimental study, the following may be of interest to you.

One. New Mexico families—as well as families in two other States included in our study—are aware and supportive of the existing state of environmental regulations.

Two. An average family—by U.S. standards—with annual, gross personal household income in the $25,000 to $30,000 range, now pays at a minimum some $40 per month—in taxes and higher prices from "passed-on" business costs required for compliance with environmental regulations—for existing environmental regulations. Notwithstanding this current $40 per month environmental bill; these households are seemingly prepared to pay an additional $8 to $14 per month for improvements in environmental safety, particularly for more stringent controls over the management and control of hazardous materials. Extrapolated across the 82 million-plus households in the United States, this implies annual benefits to improved hazardous materials management of some $8 billion to $14 billion.

Thus, New Mexicans, as well as citizens in other States, are seemingly willing to stay the course—indeed, to push the course—of vigorous efforts to maintain and improve the general state of environmental quality and, more specifically, the management of hazardous materials.

Let me conclude my testimony with a few observations concerning the transportation of hazardous materials. To be frank, I see few sources which can compete, in terms of the potential for disaster, with the threats to public health and safety posed by current practices in the transportation of hazardous materials. Numerous close calls have occurred in New Mexico and the Rocky Mountain region over the last few years: The railyard accident in Denver a few short weeks ago; six-plus incidents in New Mexico over the last 4 years; two incidents in the Laramie, Wyo. railyard over the last 3 years, one of which involved serious injuries, are but a part of the litany of incidents where we have just been plain lucky. You may be interested to know that in a neighboring State's—Arizona—program of spot checking placarded trucks, leakages of hazardous materials have been found in about half of the trucks inspected.

Now, I understand that transportation per se lies outside the domain of the EPA under current assignments of agency responsibilities. I raise the topic for the following reason: It would appear to me that the magnitude of the overall hazardous materials problem is sufficiently large to warrant the consideration of centralizing management responsibilities in one agency. That agency must have strong research as well as enforcement capabilities if it is to be effective, given the present lack of technical knowledge which shrouds the hazardous materials issue. The development of research capabilities was basic to Mr. Ruckelshaus' formation of the EPA—such capabilities were essential to an effective EPA given the uncharted waters in which the infant agency was to navigate.

To appreciate the desirability of having EPA-types of expertise applied to the hazardous waste transportation issue, consider the following: under DOT auspices, research has yet to be accomplished which sets out, even in order-of-magnitude terms, the volume and types of hazardous materials being transported on the Nation's rails and highways. In the absence of such fundamental data, efforts by States, such as New Mexico, to promulgated and justify—in cost effective terms—programs for accident mitigation and emergency response are severely hampered.

I thank you for this opportunity to express my views concerning this particular set of environmental issues which I feel are of critical importance to our State. I hope that my suggestions regarding shifts in agency responsibilities are not presumptuous. Most importantly, I hope that my remarks are encouraging to the committee and to Mr. Ruckelshaus in indicating New Mexico's support for your efforts to maintain and improve the state of environmental quality enjoyed by all of us. Thank you again.

Senator **Domenici**. Thank you very much, Doctor. Dr. Zak? We are delighted to have you.

STATEMENT OF BERNARD D. ZAK, SUPERVISOR, APPLIED ATMOSPHERIC RESEARCH DIVISION, SANDIA NATIONAL LABORATORIES

Dr. **Zak**. Senator Domenici, Mr. Ruckelshaus, ladies and gentlemen. I would like to address air quality issues in New Mexico.

New Mexico is known for its clean air and dramatic vistas. Visitors from all over the world come to see these vistas, producing a strong tourist industry. Over the past few decades, however, deterioration in visual and other air quality parameters has become significant. With the continuing economic development of the region, it is reasonable to presume that air quality will be increasingly threatened.

It is essentially the universal testimony of people that have lived here over the last few decades that air quality today is significantly lower than it was years ago. It is only reasonable to presume that air quality will be increasingly threatened.

It is useful to divide the relevant air quality issues into local and regional categories. By local issues, I mean those which affect the vicinity of sources of air pollutants out to a few tens of kilometers. By regional issues, I mean those which have a significant impact over an area hundreds of kilometers or more in dimension.

In urban areas such as Albuquerque, high concentrations of carbon monoxide are correlated with degradation in visual range, primarily during winter stagnation episodes. During the summer, episodes of visibility degradation are correlated with elevated oxidant levels. Winter and summer, in the vicinity of smelters and powerplants, the principal concern is sulpuhur dioxide levels.

And as you have heard earlier today in some indications, in regards to lead concentrations. Air quality in the vicinity of sources is strongly misunderstood. In truth, we do relatively not very well, even over flat terrain. But we do much more poorly in mountainous terrain. Air quality management needs the capability to predict the impact of sources on ambient pollutant concentrations. That's a capability which we don't have now. Consequently, programs to develop the capability to adequately model dispersion of pollutants in complex terrain are particularly important to New Mexico and to the mountain West in general.

Two complex terrain programs are now in progress. The Environmental Protection Agency supports an effort called the complex terrain model development program. It focuses very narrowly on the regulatory issue. The impacts of plumes from stacks on elevated terrain, that is on surrounding hills, ridges and the like. Two field studies have been carried out to date. The most recent, in fact, in New Mexico at Hogback Ridge near both the Four Corners and San Juan powerplants.

The Department of Energy also has an effort, a complementary effort entitle "Atmospheric Studies in Complex Terrain" or ASCOT. It is more generic in nature. It forcuses on nighttime and early morning mountain valley airflows, and the potential for such airflows to capture pollutants, resulting in high ground-level concentrations. Three field studies have been conducted to date, the first two in the Geysers geothermal area of California, and the most recent—and I might mention planned future efforts, are in the oil shale region of Colorado. It was mentioned earlier that models are perhaps not to be trusted. It's very easy to put together a model. It's much more difficult to put together a model that works. It turns out that these efforts are parallel modeling and field measurements efforts that are aimed at producing validating models. Models that if they don't work with a great precision, at least the uncertainty involved is known.

Both of these programs, their importance has been recognized, but they are being supported at something under a third of the level which a workshop held some years ago felt was necessary to solve the problem in a 5-year period of time.

I go on to regional issues and long-range transport. In New Mexico and through much of the Southwest, one particular regional air quality issue is of great importance. And that is regional visibility degradation. At present, the arid Southwest has the best visual air quality in the United States. But that visual air quality is threatened. And, as I mentioned earlier it is demonstrably lower than it was a decade or two ago.

Regional issues are tied to long-range transport of air pollutants. If pollutants are transported over a long distance before natural processes remove them from the air, then the entire region will be affected by sources at a substantial distance. In the Southwest, those natural processes are less effective than elsewhere. Rain and snow are very efficient at removing air pollutants from the air. In the Southwest we have relatively little precipitation. In the absence of precipitation, dry deposition at the ground still functions to remove air pollutants. Vegetation enhances that removal. In the Southwest, we have lower quantities of vegetation per square mile. Thus long-range transport, which is important everywhere, is even more important here.

A start on understanding the problem was made by project VISTTA, that is visibility impairment due to sulfur transport and transformation in the atmosphere, which was sponsored by the Environmental Protection Agency. That project was terminated a year or two ago. Now most resources for investigating regional air-quality problems are now being dedicated to studying acid rain in the Northeast. I might make passing reference to the fine particle standard.

Although the fine particle standard which has been under consideration by the Environmental Protection Agency for some time, it's primarily aimed at health effects. It is also likely to have some impact on visibility degradation, since it is primarily the fine particles rather than the coarse particles which degrade visibility.

In conclusion, I would like to say New Mexico shares much in common with the remainder of the Southwest. An arid environment, a vulnerability to long-range transport of air pollutants, an inability to adequately predict the air quality impacts of local sources, copious energy resources, rapid economic development, and exceptional air quality threatened by the combination of all of the above. New Mexico also shares the need to understand the regional visibility degradation the Southwest is experiencing, and the need to predict air-quality impacts in complex terrain. The programs I mentioned, the EPA and DOE complex terrain programs, and a program to essentially take up where VISTTA left off, would meet those needs and deserve support. Thank you very much.

Senator DOMENICI. Thank you very much, Doctor. Doctor, aren't you in charge of the brown-cloud study?

Dr. ZAK. I am responsible for the efforts of Sandia Laboratories in connection with the brown-cloud study, that's correct.

Senator DOMENICI. Without taking a lot of time, where are we?

Dr. ZAK. We have collected the data, we have analyzed, to a fair extent, the real time data. We are waiting on the analysis of the particulate samples which have been taken. I understand that scheduling problems and the arrival of new equipment which will be used on this analysis has delayed the analysis which the Environmental Protection Agency has agreed to do.

Senator DOMENICI. You have given us an interim report?

Dr. ZAK. Yes, that's right.

Senator DOMENICI. And there will be another that will follow, then, when that evaluation is completed?

Dr. ZAK. Yes. My guess is that it will be September or October. The original plan was to have the study completed by August.

Senator DOMENICI. Assuming the best from the evaluation, what might it end up—how much would it encompass of the problem? Will it give us the real facts, or will we need to do some more?

Dr. ZAK. I think it will give us an excellent idea of what transpired this past winter. This past winter was a relatively atypical winter, in that we did not have a large number of stagnation periods in Albuquerque. So, the insight that we get, while substantial, will not be the bottom line, if you will.

Senator DOMENICI. Dr. Hawley, environmental geologist, New Mexico Bureau of Mines and Mineral Resources. Doctor, we are glad to have you here.

STATEMENT OF JOHN W. HAWLEY, SENIOR ENVIRONMENTAL GEOLOGIST, NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES

Dr. HAWLEY. John Hawley, senior environmental geologist, New Mexico Bureau of Mines and Mineral Resources, a division of New Mexico Institute of Mining and Technology, in Socorro. Thank you very much, Senator and Administrator Ruckelshaus for letting me testify at your hearing.

My discussion primarily relates to problems of site selection for waste storage and disposal. This is an area of applied research in which I have been personally involved since 1977. My testimony also stresses broad-based research on hazardous wastes and the major problem of stabilization of uranium mine-mill wastes where strong EPA support seems appropriate, and reflects input from colleagues from NMSU and UNM as well as from NM Tech. Much of the documentation for my testimony is contained in a recent New Mexico Geological Society publication "Environmental Geology and Hydrology in New Mexico" edited by Dr. Stephen G. Wells of the UNM Geology Department and Dr. Wayne Lambert, formerly of the U.S. Geological Survey. Copies of this book are being submitted for background material for this hearing.

I want to insert into my testimony the fact that we have a new resource person in the State in the person of Dr. Lawrence Labman, our new president at New Mexico Tech that just joined us Friday. Dr. Labman for years at Penn State and the University of Cincinnati, and finally as dean in the schools of engineering and mining at the University of Utah, has been doing research on detecting fracture systems that act as conduits for flow of hydrocarbons in water, and also doing a lot of recent research and geologic processing influencing the development of desert landscapes. So he brings a lot of expertise to us. Larry, could you stand up?

Senator DOMENICI. We are glad to have you.

Dr. HAWLEY. Research to date on siting of hazardous waste management facilities has focused on development of criteria for site selection that are compatible with the State's natural environmental setting. Between 1977 and 1981 informal consultation between the State EID and Bureau of Mines staffs resulted in formulating a provisional set of geologic, hydrologic, and geochemical criteria for disposal of (nonradioactive) hazardous wastes.

During the past 2 years, I conducted a study of possible sites for disposal of low-level radioactive wastes (non-DOD-DOE), Department of Defense and Department of Energy, for the radioactive waste consultation committee of the State legislature. This work, in accordance with provisions of the Site Identification Act was done in cooperation with the radiation protection bureau of the State environmental improvement division. My report to the committee (Feb. 18, 1983), lists the siting criteria used; and information on five possible sites for low-level waste disposal facilities in the State. Please note that the hazardous waste-siting criteria of Longmire and others served as a basis for the criteria used in the low-level radioactive waste study, although the two kinds would have to be completely separated in any kind of disposal scenario.

Strict adherence to these criteria should insure that hazardous waste repositories will be placed at least 5 miles from even small centers of population or farming, mining, and industrial activity. They are very restrictive when compared with "location standards for new disposal facilities" in the current hazardous waste management regulations of the State health and environment department and the EPA.

The site selection process as applied to date in New Mexico attempts to locate those areas of the State where natural conditions (for example, climate, landforms, geology, and hydrology) provide multiple barriers that reasonably assure long-term hazardous waste containment. Shallow burial of solid waste in a secure landfill is the basic disposal strategy envisioned in my studies. Such a landfill operation would be located in the upper part of a very thick zone of essentially unsaturated Earth material. Subsurface waterflow paths should be very long in both horizontal and vertical directions. Siting criteria require that the unsaturated zone contain a large percentage of fine-grained materials, such as clay or shale, which would physically and chemically retain waste components. There should be minimal degradation of land, water, and air quality in surrounding areas for thousands of years; and opportunities for human intrusion for resource development (for example, soil, water, mineral, energy) should also be minimal.

I should emphasize that my work on site selection involves, one, evaluation of a large body of published (but largely untested) siting criteria; two, review of published and unpublished information on geology, hydrology, and soils; and three, brief visits to areas with site potential. No on-site characterization work (such as test drilling) has been done, because funding and time limitation precluded detailed geologic and hydrologic study of specific localities. Other areas that meet siting criteria probably exist in the State; but the basic geologic and hydrologic data needed for site identification are not available. Selection of possible sites definitely reflects opinions developed during my local and statewide investigations of geology and soil relationships for the U.S. Soil Conservation Service between 1962 and 1977, and the Bureau of Mines and Mineral Resources since 1977.

The five possible sites located for the radioactive waste consultation committee contain areas that may prove to be unsuited for any type of waste disposal. However, each site selected has a combination of natural features that essentially requires its consideration as a viable candidate for disposal of hazardous waste in solid form (for example, water table depths from 500 to 1,000 feet, hundreds of feet of clay-shale in the shallow subsurface, and absence of known aquifers). Even though the original purpose of my study was to locate areas for possible disposal of low-level radioactive waste, the sites also include many of the best locations in New Mexico for secure-landfill disposal of many types of hazardous wastes. These areas definitely deserve consideration as locations for processing and temporary storage facilities; and they could be used for generic pilot studies of various waste-management strategies.

I am well aware of the immediate need for secure landfill sites for hazardous waste disposal in major urban and industrial areas such as the Albuquerque area. However, having just completed a rather comprehensive siting investigation, I feel qualified to testify on the pitfalls associated with this type of applied research. My basic philosophy is that Murphy's law always pertains to hazardous waste management; and I feel that our best sites should really be classed as our least bad disposal sites. I believe that we must accept the basic premise that no single site will meet all siting criteria. The fundamental process of criteria selection is always state-of-the-art and subjective, to say the least. Too often the tendency has been to pick a seemingly viable site and then try to design siting criteria that fit the field situation.

In New Mexico (as in any arid region) hydrology and geology are powerful socioeconomic, cultural, political forces. Historically, there has been no intensive land use without a water-, mineral-, or soil-resource base. Water availability obviously is the key factor. A valid question remains: Is the worst place for economic survival in this region really the best place for hazardous waste disposal? If I were from a much more humid and populated part of the country (and I have lived and worked in such areas), I could easily believe that vast areas of the Southwest are full of potential waste disposal sites. I am, therefore, quite concerned that the seemingly restrictive siting criteria that I have used will lull many into a false sense of security about our ability to cope with present and future hazardous-waste disposal problems. I fear that we may choose to continue dumping a wide variety of hazardous wastes in landfill and injection well operations, instead of reserving such facilities for a final product or ultimate residue of an intensive waste treatment effort. The technology for waste processing is available and its use should be encouraged. Better to do it right the first time than to expect the environment to be restored by various remedial measures paid for out of some sort of nebulous superfund.

I add this word of caution precisely because we are in a relatively dry and sparsely populated region where hydrologic and surficial geologic processes appear to act very slowly in many places. We know that many hazardous substances decay very slowly and exist in undiluted form for long periods simply because of our arid conditions. We also have a great deal to learn about the behavior of fluids and gases, particularly organic compounds in thick unsaturated zones of dry regions. In a region of limited water supplies and ground water recharge opportunities, we cannot afford any type of aquifer contamination. These observations lead me to request that the EPA give strong support to research efforts that will help us deal more adequately with the many uncertainties of hazardous waste management We need all the help we can get to limit the number of time bombs we leave for future generations.

The following statement refers to a "Proposal for a Hazardous Waste Task Force" submitted by the director of the New Mexico Engineering Research Institute, UNM, to members of the State legislature and Governor Anaya on February 2, 1983. The proposal was initiated by Dr. Marx Brook, who is here, director of the research and development division at New Mexico Tech. Much of the basic material was prepared by Dr. Daniel B. Stephens, associate professor of hydrology at New Mexico Tech, Dr. Dennis Zalen of the New Mexico Engineering Research Institute at UNM, and Delmar Calhoun, institute director. A number of other researchers at UNM and NM Tech and State EID personnel have also contributed to this document. This is in the record.

A complete report, according to the proposal, representatives of the task groups would comprise a hazardous waste task force, administered by the director of the New Mexico Engineering Research Institute. In addition, an advisory committee appointed by the Governor, would represent interested citizens, legislators, industry representatives, State agencies, and national laboratories.

Just to go over the three major objectives. One would be to designate regions within New Mexico which may be acceptable to the public and industry for locating hazardous waste treatment, storage, and disposal facilities.

Two, inventory the existing hazardous waste quantities, compositions, locations, generation process and handling. One, how much hazardous waste is there? Two, what are the hazardous wastes? Three, where and how is waste generated and handled?

Three, compile and evaluate the state-of-the-art for technologies in hazardous waste treatment, storage, and disposal, including economic considerations, potential environment impacts, and public relations, as they may pertain to conditions in New Mexico.

We were asking, I think the State to set up something in the order of $3 million, a 3-year study, but it could be quite a bit more. I will close with four or five points that I think deserve immediate EPA attention. And they are somewhat related to hazardous wastes, but they also cover some broader issues.

First, there is a need for a major research effort on appropriate management strategies for stabilization of uranium mill tailings and mine spoil. In terms of volumes of radionuclides and heavy metals that exist in a relatively unstable near-surface environment, this is probably the biggest problem we face in northwestern New Mexico.

There is a need for large-scale, in-depth studies of fluid and waste movement in semiarid terrain. Generic research is particularly needed on hazardous waste interaction with the soils and surficial geologic formations that occur along waste transportation routes and near waste management facilities.

Need for a research on: (a) Detection of significant leaks in wastewater injection wells. (b) Adequacy of current guidelines for mechanical integrity tests of injection wells. (c) Protection and rehabilitation of freshwater aquifers near wastewater injection wells.

There needs to be research on maximum permissible concentrations of contaminants in drinking water. Many standards are set by the lower detection limit of instrumentation. Improved instrumentation and long-term toxicological studies should continue, particularly with respect to hazardous waste. Thank you very much for an opportunity to speak.

Senator DOMENICI. Now, we will hear from Charles Kolstad, Economics Group, Los Alamos National Laboratory.

STATEMENT OF CHARLES D. KOLSTAD, ECONOMICS GROUP, LOS ALAMOS NATIONAL LABORATORY

Mr. KOLSTAD. The Los Alamos National Laboratory has conducted several studies of the efficiency of current and alternative air-pollution regulations. As part of the congressional review of the Clean Air Act, we conducted a study of the prevention of significant deterioration [PSD] provisions of the act for the National Commission on Air Quality. We have also examined sulphur control alternatives for copper smelters in the Southwest. I will relate to you today some pertinent results of these and other studies. I will focus my remarks on the use of economic incentives to control pollution, particularly in the context of the protection of regional visibility.

As you are aware, some of the air-pollution problems here are unique to this part of the country; other problems are quite similar to those found elsewhere. I will describe three issues of importance in this region and then discuss their resolution.

A problem found everywhere is the difficulty in achieving prompt compliance with regulations. It may be just good business practice for a firm to delay compliance with environmental regulations, litigating to the maximum extent possible. However, assuming the regulation is appropriate, such delay is socially undesirable and places a heavy financial burden on companies involved. This difficulty can be traced directly to a nonalinement of company incentives and social goals.

A second difficulty has to do with existing sources and is more a question of fairness than economic efficiency. Many sources that predate the 1971 Clean Air Act Amendments have little or no pollution control and are thus much more significant contributors to pollution than newer sources. Perhaps for good reason, these sources are often subject to much weaker regulation than newer sources. It is often perceived as unfair to require sources that were built in full compliance with what was then the law to retrofit costly pollution control. In our area, the copper smelters and a few older powerplants are responsible for the bulk of the current and anticipated SO_2 loading on the region, yet much of the regulatory attention is on newer sources.

A third issue that is unique to the West is the importance of good visibility. Many of the scenic resources of the country are located in the West. A major reason for the attractiveness of the national parks and other scenic areas is the spectacular vistas that have been common here. Yet these vistas can be destroyed by even moderate amounts of air pollution. The Clean Air Act Amendments of 1977 recognized the importance of visibility protection, yet regulations have focused only on visible plumes and not on the general level of visibility in the region. This is despite the fact that cost-benefit studies have shown that regional visibility should be strictly controlled. The general level of visibility is inversely proportional to the level of fine particulates in the air. Due in large part to emissions of sulphur and nitrogen, these fine particulates can travel over great distance before leaving the atmosphere, as a previous panel member mentioned. As you may know, fine particulates derived from sulphur and nitrogen are believed responsible for the acid deposition in the Northeast. Thus, controlling visibility in the West is a very similar problem to controlling acid deposition in the East. The sulphur emissions in this part of the country principally are due to smelters and powerplants. Nitrogen pollution in the region principally is due to local motor vehicles and powerplants and possibly the Los Angeles urban plume.

Economic incentives are regulations which make it in a firm's best economic interest to control pollution in a socially desirable manner. There are two basic types of economic incentives—emission fees and marketable emission permits. If a firm is charged $1 for every pound of sulphur emitted, then we would expect the firm to take it upon itself to reduce sulphur emissions in order to save money. Similarly, if the Government grants emission permits in terms of allowable sulphur emissions and such permits can be bought and sold, then no matter how the Government initially allocates these permits, they will be traded so that all plants are controlled at the most cost-effective levels. The current offsets program is a type of marketable permit system. Because such permit or fee systems aline private incentives with social goals, the first of the issues addressed above—prompt compliance—is effectively resolved through the use of economic incentives.

However, there is an asymmetry between the use of emission fees and marketable emission permits. Although the relative merits of emission fees and marketable emission permits have been widely discussed in the economics literature, I will briefly review them here. Emission fees generally guarantee that sources control up to the point where they are indifferent between paying the fee and buying an additional unit of emission control. If industry control costs are not perfectly known by the Government, then it may be difficult to predict how much emissions will result from a specific fee. On the other hand, marketable permit systems assure that a given level of pollution is achieved but with no consideration to cost. Thus, if the regulator's only concern is that industry bear a given cost for pollution control, then emission fees are preferable. Let me just say, that in our work for the National Commission on Air Quality, we concluded that given the uncertainty on energy development in the Four Corners region, a nonadjustable emission fee to protect PSD increments would result in about 20 percent higher costs than a nonadjustable marketable permit system.

Another asymmetry between fees and permits is that emission fees by their very nature involve a significant resource transfer to the Government—unless an innovative rebate scheme is devised. But marketable emission permits may involve no payments to the Government, depending on how they are initially allocated, and thus may be much more politically acceptable. Another problem with an emission fee is that it is unclear how regulated industries, such as electric utilities, will respond to an emission fee.

In returning to the original three issues, let me explore the effectiveness of a marketable sulphur emission permit system in protecting regional visibility. My remarks can also be readily transferred to acid deposition control in other parts of the country. What I would like to do is describe a simple hypothetical permit system. Any actual permit system would undoubtedly be somewhat different. The purpose of considering an example is to illustrate the potential advantages of a marketable permit system in controlling emissions. The permit system I will describe might replace the best available control technology regulations but not ambient standards or the other parts of the new source review process. I will focus on sulphur and thus assume that nitrogen emissions are controlled at an acceptable level.

Suppose we can decide on an overall sulphur emissions level for some multistate region of the Southwest, a level that provides acceptable visibility protection. Such an emissions level may be roughly the same as current emissions, less than current emissions, or possibly more. Suppose we then allocate emission permits to existing sources so that the aggregate issuance of permits matches the predetermined acceptable level of emissions. If a source emits more than permitted, the source will have to either reduce emissions or acquire additional emission permits from other sources. It would be expected that those sources that are currently loosely controlled, such as some of the older powerplants and smelters, would sell some of their permits to more tightly controlled facilities, resulting in savings for all concerned. If new sources wish to locate in the region, they will have to acquire permits from existing sources. It is also conceivable that environmental groups could acquire and retire permits, in essence paying existing sources to control further.

Now, how effective might such a marketable permit system be? As mentioned earlier, giving companies incentives to control pollution solves one of the problems of regulation control—prompt compliance. In addition, the question of equity relative to old versus new sources would be largely resolved since most rights to emit would probably be vested in existing sources. Trading would then occur to distribute more equitably the burden of control. Further, visibility would be protected reasonably well over the long term, at least from further erosion due to new sources entering the region.

I would now like to summarize my basic points. In our research we have found that regional visibility may be inadequately regulated by the Clean Air Act. This finding is echoed by other researchers. We have also found that economic incentives, particulalry marketable emission permits, have many attractive properties for controlling air pollution. They can reduce the administrative complexity of regulation, solve problems of fairness in controlling various sources and assure prompt compliance with regulation. Thus, it would appear that the use of economic incentives to control visibility should receive serious attention and further examination. Thank you.

Senator DOMENICI. Thank you very much. Dr. Joseph Mauderly, Lovelace Inhalation Toxicology Research Institute.

STATEMENT OF JOE L. MAUDERLY, LOVELACE INHALATION TOXICOLOGY RESEARCH INSTITUTE

Dr. MAUDERLY. Thank you. I am a physiologist and investigator whose primary interests are in the conduct of research that will provide an improved basis for estimating the potential adverse health effects on man of environmental and occupational exposures to airborne pollutants. I am currently supervisor of the pathophysiology group of the Inhalation Toxicology Research Institute in Albuquerque, N. Mex. A personal résumé is attached as appendix A. By way of background, the institute has a multidisciplinary staff of 74 professional and 132 supporting personnel and is operated by the Lovelace Biomedical and Environmental Research Institute, a nonprofit corporation for the U.S. Department of Energy. An extensive research program focusing on the toxicity of airborne materials is conducted for the U.S. Government in Government-owned and equipped facilities. The program consists of a balance of basic and applied short- and long-term research. Among the problems being studied at the institute are several related directly to concerns here within New Mexico, including the effects of inhaled radioactive materials such as those of concern in the uranium mining and waste-disposal fields, effects of inhaled materials resulting from coal utilization and effects of materials found in urban pollution.

I have had the opportunity to interact with the Environmental Protection Agency [EPA] in several ways. Although the institute currently has no EPA funding, we have conducted research for that Agency in the past, and I have worked with EPA project managers in the roles of principal investigator and program manager. I have maintained close contact with EPA scientists in my discipline to share information on techniques and results, and have worked with them in scientific societies. In addition, I have participated in several EPA-sponsored meetings and workshops, two recent examples being workshops on environmentally related nononcogenic (noncancerous) lung disease and on health effects of inhaled oxidant gases. In both of these, I worked with other scientists to summarize the current status of our knowledge and identify needs and appropriate directions for future research.

I am appearing today at your request to discuss the role of animal research in assessing the health risks of airborne environmental pollutants, the nature of the questions we are addressing and the problems we face. The message that I bring is that inhalation toxicology studies in intact animals continue to be a critical link in the assessment and management of environmental health risks and that significant complex questions remain to be answered by these studies.

The process of understanding and controlling adverse effects of environmental agents on human health involves the dual processes of risk assessment and risk management. Risk assessment seeks to determine the existence, nature and does-response relationships of adverse effects and to link this information with predictions of human exposure to estimate the health impact on an individual, local or national scale. Risk management seeks to weigh the predicted effects against potential benefits, apply socioeconomic and political considerations and to develop and implement the most appropriate controls of the material in question. Toxicological studies are directed toward the first of these processes; that is, determining the existence, nature and dose-response relationships of adverse health effects. However, it is only by continuing through the remainder of the risk assessment and management processes that the toxicological studies can bear fruit, or in other words, pay off the investment that has been made.

Toxicological studies in intact animals are an essential component of our ability to detect and understand adverse health effects. These studies provide information that can lead to appropriate regulatory actions, including, in some cases, the decision not to regulate. The process of evaluating the toxicity of materials in our environment may be thought of as having the characteristics of a three-legged stool, which, as you know, can satisfactorily serve its function only if all three legs are present. In this case, the three legs are epidemiological studies of man, toxicological studies in intact animals and bench-top physical, chemical, macromolecular, and cellular studies. For some environmental materials, we have the mixed blessing of positive epidemiological data from man. Regrettably, the existence of these data imply that adverse health effects have already occurred in man; however, it is true that the data most relevant to effects in man should be those obtained from man himself. There are no epidemiological data bases for many of the materials of present concern and, of course, none for new materials that are introduced into man's environment. Some materials lend themselves to experimental exposures of man to study rapidly occurring and easily reversible effects; however, these studies give no information about long-term and permanent effects which are often the primary concern. In the absence of data from man, we turn to the experimental toxicologist for answers. Studies in intact animals allow us to apply carefully controlled and documented exposures so that the information derived is known to be specific for the material of concern. In contrast to studies in isolated cell systems, studies in animals allow the integrated functions of inhalation, retention, metabolism, toxic expression, and repair to occur as they do qualitatively in man. Animals can be studied as individuals and populations by the same clinical and epidemiological endpoints used for man. Effects can be studies in relation to age, sex, activity level, nutrition, and complicating diseases; factors that are difficult to separate in man and impossible to duplicate closely in nonanimal systems. The results of animal studies can also be extended to assessing the risk to man by comparing the toxicity of the material in question to those of other agents for which epidemiological data do exist.

Let me focus briefly on an issue of great current concern to the public, lawmakers and researchers alike; the use and misuse of animals in research. There continues to be concern for the possible abuse of experimental animals and there are vocal factions calling for severe restrictions or even elimination of the use of animals. Let me assure you that I and my colleagues are also concerned for the welfare of laboratory animals and that they be used conscientiously and only when necessary. My origins in animal husbandry, training in veterinary medicine and research experiences have biven me a background for deep personal concern and appreciation for the wise and humane use of animals. First, it is clear that incidents of abuse have occurred and must be prevented by appropriate systems of checks and balances. However, it is also clear to knowledgeable individuals that our ability to provide for human welfare would be severely impaired by overreactions to these infrequent abuses. There is little I would like more than to reach the goal of being able to obtain the necessary toxicological information in nonanimal test systems, thus avoiding the need for animals to experience the very same adverse health effects we are seeking to prevent in man. I am enthusiastic about the progress that is being made in reaching this goal and would like to think that it might largely be achieved in my lifetime. However, one key pont is often overlooked or smothered by the emotion of the issue. If we are to reach the goal, it will only be done through studies which relate results of nonanimal studies to the expression of health effects in intact animals and man, thus confirming the validity of the extrapolations. Therefore, continued animal studies are actually a key element of reaching the goals of the very individuals and factions which are calling for their end. There is a real danger of throwing out the "baby" of required knowledge with the "bathwater" of real and imagined abuses and thus preventing the progress we all desire.

Let me now turn to the nature of the toxicological problems we are currently facing. The easy environmental pollution questions have been answered and those that remain are more complex and difficult to address. We know that airborne materials can cause adverse health effects, and in many cases they have been shown to do so by both epidemiological and animal studies. Many of these materials have been regulated and these controls have resulted in dramatic improvements of air quality. However, we know little about the long-term effects of the low levels of many materials that continue to exist in the environment, and this hampers our ability to decide whether current standards are adequate and what additional standards should be set. We are just beginning to address how long-term effects might be distinguished from the normal degenerative effects of aging. Some of the changes in the lung thought likely to result from chronic exposure to pollutants are similar to those thought to occur normally during aging. We are also beginning to turn more attention to the interactive effects of components of complex mixtures of inhaled materials, such as gases, vapors and particles. In some cases, we are discovering that potentially toxic materials may not cause their effect unless inhaled in a certain form or in combination with other materials. An example of this is the carcinogen, benzo(a)pyrene, which has been found to cause lung cancer in animals only when introduced into the lung with particles which bind it and hold it in the lung long enough to cause cancer. We badly need to know more about interactions among different insults such as air pollution, respiratory infections, and tobacco smoke in causing lung disease. More attention is now being focused on potentially sensitive subpopulations and the question of the extent to which standards should be based on these groups rather than on the general population. For example, recent data suggest that newborn individuals with developing lungs may be at greater risk than adults and that airborne materials might retard or prevent normal lung development. Another problem is the lack of data for new agents introduced into the environment by developing energy technologies and for new materials introduced into the workplace.

The problems I have just described are a sample of the questions currently being asked of researchers in the field of inhalation toxicology. We have many of the experimental tools needed to provide answers, and more are being developed. The answers won't come easily or cheaply. Most of the required experiments are complex; they take time and require an interdisciplinary approach. "Critical masses" of scientists with physical, chemical, biological, biomedical, and mathematical backgrounds are required to work as research teams in laboratories having extensive animal exposure and evaluation facilities. The progressive and long-term natures of the needed studies impose requirements for both adequate and stable funding. Studies in intact animals and nonanimal test systems must be conducted in parallel and in an interactive manner. Progress has been and is being made; however, the challenge remaining to researchers, responsible Federal and State agencies, lawmakers, and taxpayers is great. I am personally pleased to have a role in answering these questions.

I would be pleased to respond to any questions you might have. Thank you.

[Attachments to Dr. Mauderly's statement follow:]

APPENDIX A
RESUME

MAUDERLY, JOE L.

Physiologist, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, P.O. Box 5890, Albuquerque, NM 87185

Date of Birth: August 31, 1943
Place of Birth: Strong City, KS
Social Security Number: 514-42-5808

EDUCATION

B.S. Kansas State University, Manhattan, KS, 1965
DVM, Veterinary Medicine, Kansas State University, Manhattan, KS, 1967

EMPLOYMENT

1980-Present	Pathophysiology Group Supervisor, Project Coordinator and Physiologist, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Albuquerque, NM
1969-1980	Physiologist, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Albuquerque, NM
1967-1969	Small Animal Veterinarian and Physiologist, USAF, U. S. Army Natick Laboratories, Natick, MA

AFFILITATIONS

American Physiological Society, Respiration Section
American Thoracic Society, Assembly of Environmental and Occupational Health
New Mexico Chapter, American Thoracic Society
American Society of Veterinary Physiologists and Pharmacologists
World Association of Veterinary Physiologists, Pharmacologists and Biochemists
Comparative Respiratory Society
American Association for the Advancement of Science, Biological Sciences Section
American Veterinary Medical Association
New Mexico Veterinary Medical Association

APPOINTMENTS

1. Associate Editor, *Laboratory Animal Science*, 1978 - 1982

2. Editorial Board, *Experimental Lung Research*, 1983-

3. Ad Hoc Review Committee for NIH Contract Proposal, 1973

4. NRC-ILAR Subcommittee on Animal Models for Aging-Carnivores, 1978-1979

5. Ad Hoc Review Committee for NTP Proposal, 1980
6. Program Committee, American Thoracic Society Assembly of Environmental and Occupational Health, 1980-1981, 1983-.
7. Ad Hoc Visit Review Committee for E.P.R.I. Contract, 1983

GUEST LECTURER

Baylor College of Medicine
Iowa State University
Kansas State University
Michigan State University
New York University
Ohio State University
University of California, Irvine
University of Cincinnati
University of Kentucky
University of West Virginia
University of Wisconsin

PROFESSIONAL INTERESTS

Dr. Joe L. Mauderly's primary interest is in the conduct of research that will provide an improved basis for estimating the potential adverse effects on man of environmental and occupational inhalation exposure to airborne toxic materials. His primary disciplinary interests are the development and application of cardiopulmonary function measurements of animals and the use of these tools in the study of lung disease resulting from inhaled toxic materials. Emphasis has been given to measurements of both anesthetized and unsedated subjects ranging in size from hamsters to ponies. The inhaled materials studied have primarily included radioactive and non- radioactive agents associated with energy conversion processes. At present, a major portion of his effort is directed toward studies of inhaled automotive exhaust. Interests also encompass animal models of human lung diseases, clinical applications of lung function measurements, comparative lung physiology, function, influences of age and sex on lung structure and function, bronchopulmonary lavage as a therapeutic and investigative tool, inhalation anesthesia, teaching pulmonary physiology and research management.

PUBLICATIONS, AND PRESENTATIONS

Dr. Mauderly is author or co-author of over 140 scientific publications, abstracts and documents and has given 70 presentations before scientific audiences.

Senator DOMENICI Dr. O'Brien, you are last but not least.

STATEMENT OF HAROLD A. O'BRIEN, CHAIRMAN, NEW MEXICO RADIATION TECHNICAL ADVISORY COUNCIL

Dr. O'BRIEN. Mr. Chairman, Mr. Ruckelshaus. I have a Ph. D. in chemistry from the University of Tennessee and am a group leader at the Los Alamos National Laboratory. I am chairman of the New Mexico Radiation Technical Advisory Council and have served in that capacity throughout the hearings during the New Mexico radiation protection regulations during which the regulations for the control of uranium mill tailings were adopted. I was requested to provide you with a perspective of the New Mexico radiation regulations, dealing with radiation and must consent to all radiation regulations approved by the board. I have included in the testimony a copy of the current membership of the council.

New Mexico's uranium mill tailings regulations were developed in a lengthy public hearing process, in which the Nuclear Regulatory Commission provided extensive technical testimony in support of its former regulations. Those Nuclear Regulatory Commission regulations are now recognized by the Nuclear Regulatory Commission as being inappropriate and are proposed to be suspended. In addition, the general public, environmental groups, and industry testified and were cross-examined under oath. Testimony since 1979 on these issues comprises a hearing record that stands over 2 feet high and exceeds 4,700 pages. New Mexico's Environmental Improvement Board adopted, with the radiation technical advisory council's advice and consent, regulations based upon the testimony and on the practicability of these regulations in New Mexico to protect public health and safety as provided for by law. With the exception of a lawsuit in 1980 over two minor issues, no lawsuits were filed contesting these New Mexico regulations.

New Mexico has much to be proud of with respect to its regulations. It requires performance standards instead of placing reliance on design standards. New Mexico regulations are certainly the most stringent in this country. This is a key point. New Mexico will insist on a licensee's meeting these performance standards for reclamation of a tailings pile before the State will accept custody of the pile. Mere reclamation to a design standard, whether it works or not, is not acceptable. The concept of approving a design without insisting on performance is irrational. Although New Mexico has not yet accepted a single stabilized tailings pile, our continued care fund, now standing at $5.8 million, offers excellent assurance that costs for inspection and necessary maintenance of any future State-accepted pile, if needed, would be covered well past its 200-year design standard. It should be mentioned that it was only through a series of insistent criticisms by New Mexico that the Nuclear Regulatory Commission raised their long-term inspection charge to $250,000 collected at the end of operations, whereas New Mexico collects $1 million at the beginning of operations. It is interesting to note that the newer Federal proposals such as the Environmental Protection Agency's 40 CFR 192 have replaced the Nuclear Regulatory Commission's former fix-it-and-forget-it philosophy in favor of institutional controls, scheduled inspections, and necessary maintenance. This is the position adopted by New Mexico in its regulations.

The Nuclear Regulatory Commission originally prohibited self-insurance. Later that agency's staff study for nuclear powerplants, involving much larger sums of money, concluded that the utilities themselves were better assurance than bonding companies. New Mexico reached a similar conclusion in 1981 and permitted limited self-insurance with specific controls as do Texas and Colorado.

To facilitate comparison, I have prepared a table showing comparable Nuclear Regulatory Commission regulations, proposed Environmental Protection Agency standards, and New Mexico regulations. I will discuss a few of these very briefly.

Sheer pragmatism caused New Mexico to forego acceptance of the Nuclear Regulatory Commission's arbitrary 3 meters of soil cover over tailings piles. This rejection was based upon the vulnerability of soil alone against erosion and the areas that would have had to be denuded to obtain this cover, thus creating dust bowls in our fragile environment. For example, to cover the Kerr-McGee pile would involve scraping off a foot of top soil over 12 square miles. This is more top soil than exists in much of the Ambrosia Lake area.

Similarly, the picocurie per square meter per second emanation rate was rejected since it is not a health standard. The important point here is that the public does not breathe emanation rates, but instead breathes radon concentrations. For many years the maximum permissible concentration in air radon of 3 picocuries per liter has been an accepted health standard for an individual in an unrestricted area. Such values have stood the test of time and appear to be adequate to protect the health and safety of the people of this State.

I would like, at this point, to insert a parenthetical comment based upon a statement made earlier this afternoon. Mining emission regulation should be approached with prudence. Mine venting is essential to reduce the radon working levels in the mines to acceptable levels. In recent months, when the Ambrosia Lake mines and mills were temporarily shut down for economic reasons, the Environmental Improvement Division, in conjunction with the uranium industry, performed radon air concentration measurements and compared these measurements with those performed when the mines and mills were in full operation. Surprisingly, there were no significant differences in these measurements. This phenomena requires further study before the real need for mine air-venting control can be determined. Simply, the recommendation that tailings piles must be stabilized for thousands of years must be carefully considered prior to adoption. This issue was discussed extensively by expert witnesses during our public hearing process.

On the basis of that testimony, New Mexico adopted a 200-year performance standard. New Mexico has, in my opinion, an excellent set of radiation regulations. I am not saying that they are perfect. They may need some minor adjustments based upon experience and as a result of the Nuclear Regulatory Commission's final regulations.

In conclusion, I wish to thank you, Mr. Chairman, for your efforts on behalf of the best interests of our State; particularly in regard to the uranium mill tailings Radiation Control Act.

To you, Mr. Ruckelshaus, I invite your attention to the many technically sound and practical features of New Mexico's regulations, and the extensive hearing process through which they were adopted. After all, New Mexico has over half of the uranium mining and milling industry of the United States and must live in close proximity with it. Our regulations must not only be appropriate for the present while the industry operates, but must also be appropriate for the very long term and future after the industry ceases to operate.

We have strived diligently to arrive at practical regulations which the industry can live with and still meet the prime consideration to protect the health and safety of the people of New Mexico and its environment. We believe we have. Thank you.

Senator **Domenici**. Thank you very much. Doctor, you told us about the extensive record. And you heard from experts. Just quickly, what does that mean? What experts testified?

Dr. **O'Brien**. In the matter of human health risks, for example, we had Dr. Robley Evans, a recognized expert in health effects of low levels of radiation. He has been studying, for example, people that were exposed to radium in the dial-painting industry and two debutants who were given radium cocktails back in the twenties.

Senator **Domenici**. So these were national experts in certain of the fields that were important to the investigation?

Dr. **O'Brien**. That's correct.

Senator **Domenici**. They weren't all New Mexicans?

Dr. **O'Brien**. No. Absolutely not. They were experts that were brought in by the environmental groups, and experts brought in by industry, and we also listened to the testimony of the Nuclear Regulatory Commission in providing technical arguments to support adoption of their regulations. We listened to everybody.

Senator **Domenici**. Who conducted the hearings? The technical group or the Commission?

Dr. **O'Brien**. The hearings were conducted by the environmental improvement board. Sometimes they had a hearing officer, sometimes the chairman of the board conducted the hearings.

Senator **Domenici**. I have no further questions. I want to thank all of you for appearing. To some extent, we have dealt your expertise a short shrift here today. and I hope you will forgive us. But that's all the time we could put together.

As we move through these very important issues, I have a real feeling that you will be called upon again, certainly from our standpoint, to review these carefully. And if we need you up there, or we need some help or some technical advice, we will, hopefully, avail ourselves, and we are delighted that you were able to be with us.

Bill, would you like to make some closing remarks?

Mr. **Ruckelshaus**. Only to echo what you say, Pete. It is frustrating to listen to people so obviously knowledgeable about all these subjects and not be able to spend more time going over it with you. But I can assure you we will take your testimony into account and study it carefully in accrediting many of the issues that all of you brought up, try to adjust our thinking in line with much of what we heard today. I know I have learned a lot, and I appreciate the invitation.

Senator **Domenici**. I want to make one last comment that I think applies more to the last testimony, but it permeates the whole afternoon. And I mean this in all sincerity.

I think one of the real problems of the last few years, with reference to EPA, is the scientific research that they carry on directly within their own jurisdiction and that which they are credited for. I am of the opinion that we have put enough money in the last 5 or 6, 7 years, where EPA should have a research base that's second to none. That doesn't mean that they have to have labs all over the country that they own. But my impression, Bill, has been, from speaking to some of my own people who do work for DOE, who work for EPA, or work with them and through them, is that EPA must pursue with more vigor the establishment of stronger research facilities over which they have control and exercise their jurisdiction and encourage basic research. It's obvious that there is plenty of talent around, but I am not sure that the EPA has put it together in commensurate with the number of dollars we have put forward.

I don't expect you to comment. But if you feel so disposed, we would welcome it. But in any event, I feel that way. And some of my scientists in the State have told me that. I won't squeal on any of them that are here, but two or three of them—two at this table have told me that already in the past, or their institutions through other scientists, have told me that. I would like to thank you again for attending.

I note that there was some indication in the paper that we would not have public participation. That's true. We never have public participation at a hearing. We have witnesses determine their area of expertise and, frankly, the general rule in the Senate is that they submit their testimony in writing 3 days before we meet. That gives everybody a fair shot at looking at—we waived that for some of our witnesses, and were delighted to do it.

I hope that if any of you came with any specific questions you would like to ask, either of Mr. Ruckelshaus or myself, I hope you will understand that we can't do that today. But I personally am willing to answer any of your questions. I am back in the State frequently, and if you would like to corral a couple of our staff here and give us your name and address, we will call you if you are prompted to inquire of me for something that occurred today, or something you came with.

We have two staffers here, one from the majority and one from the minority in the Senate. Linda Findlay, with the majority and Mr. Yago right here, who is with the minority. He has been there for a long time, and I am sure they will stay a couple minutes and get your names if you want to ask me some questions. We will get back to you on the phone or in person.

We stand adjourned.

[Thereupon, the hearing was adjourned.]

[Statements and other material submitted for the record follow:]

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Assistant Director

STATE OF NEW MEXICO
NEW MEXICO LEGISLATIVE COUNCIL
334 STATE CAPITOL, SANTA FE, NEW MEXICO 87503
Telephone 505 827-3700

June 30, 1983

File No. 205.87-83

The Honorable Pete V. Domenici
10013 New Federal Building
500 Gold S.W.
Albuquerque, New Mexico 87101

Dear Senator Domenici:

The joint-interim legislative Radioactive Materials Committee (formerly the Radioactive Waste Consultation Committee) at its June 23 meeting in Carlsbad unanimously adopted the attached resolution pertaining to state regulation of standards for the disposition of mill tailings.

The committee feels this resolution reinforces the state legislative intent as expressed by Senate Joint Memorial 15 of the 1983 legislative session. This memorial was adopted with only one dissenting vote (copy also attached).

I am also enclosing at the request of the committee a copy of a letter I wrote to Ms. Whitman, an advisor to Governor Lamm of Colorado, regarding the New Mexico legislature's and the Radioactive Materials Committee's position on the mill tailing situation.

Senator Joseph Gant, chairman of the committee, respectfully requests that the attached resolution and memorial be made a part of the record of your July 6 hearing in Albuquerque.

Sincerely yours,

Richard H. Folmar

RICHARD H. FOLMAR
Assistant Director

RHF:frb

Enc.

RESOLUTION OF NEW MEXICO RADIOACTIVE MATERIALS COMMITTEE OF THE NEW MEXICO LEGISLATURE

WHEREAS,

The Environmental Protection Agency has proposed standards for management of active uranium tailings piles, including standards (i) providing for non-degradation of groundwater measured generally at the toe of the tailings. (ii) requiring stabilization of tailings, for 1,000 years to the extent reasonably achievable with a minimum of 200 years; and (iii) restricting radon emanation to 20 pico curies per square meter per second measured at the tailings pile ("EPA Proposed Standards"), 48 Fed. Reg. No. 84, p.19602, Apr. 29, 1983;

WHEREAS,

By Agreement pursuant to the Atomic Energy Act the State of New Mexico regulates uranium mill tailings in New Mexico, through the New Mexico Environmental Improvement Board ("Board") with the advice and consent of New Mexico Radiation Technical Advisory Committee ("RTAC")[1]. The Board and RTAC after an extensive public hearing with cross examination of all witnesses, including the Nuclear Regulatory Commission ("NRC") witnesses, adopted uranium mill tailings regulations based on state specific concerns. The Board found the new regulations equivalent, to the maximum extent practicable, to the proposed NRC regulations on mill tailings;

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1. Pursuant to §74-3-2 NMSA 1978 the RTAC members shall be individuals with scientific training in one or more of the following fields: diagnostic radiology, radiation therapy, nuclear medicine, radiation or health physics or related sciences with specialization in radiation.

WHEREAS,

The Uranium Mill Tailings Radiation Control Act of 1978 ("UMTRCA") contemplates agreement states will adopt standards equivalent, only to the extent practicable, to standards of the ("NRC") or the Environmental Protection Agency ("EPA").

WHEREAS,

New Mexico has more than one-half of all uranium mill tailings in the United States.

WHEREAS,

The EPA Proposed Standards differ in major and critical respects from New Mexico standards.

WHEREAS,

The 1983 New Mexico Legislature adopted a Joint Memorial supporting the uranium mill tailings regulations adopted by the New Mexico Environmental Board and sent a copy to the EPA. The Joint Memorial outlines the New Mexico regulations and confirms the Board has determined the New Mexico regulations provide for the health and safety of the public and the environment based upon the specific conditions existing in New Mexico.

NOW, THEREFORE, BE IT RESOLVED THAT

The New Mexico Radioactive Materials Committee hereby opposes the EPA proposed standards as impracticable and contrary to the New Mexico Radiation Protection Regulations and the New Mexico Water Quality Regulations and states the following reasons:

1. EPA's so-called "non-degradation" standards for groundwater will not permit addition of constituents to groundwater above background levels measured upgradient from the tailings pile for certain constituents even though such additions could have no harmful effect to either health or the environment. For other constituents, standards are proposed by EPA which

are more restrictive than New Mexico's groundwater standards. (§3-103 N.M. Water Quality Regulations). The New Mexico standards were determined to be at levels which are safe and contain a margin for safety. Non-degradation is contrary to the laws of the state of New Mexico. The New Mexico Constitution, Article XVI, Section 3 and New Mexico Statutes (Section 72-12-2 NMSA, 1978), provide for the beneficial use of New Mexico water resources. Beneficial use is the basis, the measure and the limit to the right to use of waters in New Mexico.

The New Mexico Water Quality Act provides that "reasonable degradation of water quality resulting from beneficial use shall be allowed." (Section 74-6-12 F). The New Mexico Water Quality Control Commission ("WQCC") has promulgated numerical standards and has provided that meeting either its numerical standards or the existing concentrations at the time the regulations were adopted, amounts to reasonable degradation of water quality resulting from beneficial use in New Mexico. (Reasons of WQCC of January 11, 1977).

The New Mexico Water Quality Control Commission also provided that its standards or existing concentrations were to be measured at the "place of withdrawal for present or reasonably foreseeable future use." Moreover, the New Mexico Environmental Improvement Board found that the New Mexico Water Quality Control regulations were adequate to protect public health in connection with tailings piles. (Board's statement of reasons of October 9, 1981, pages 9-11).

Any standards adopted by EPA which do not allow additions of constituents to water up to levels which are safe directly interferes with New Mexico's exclusive right to provide for the beneficial use of the state's water resources. Furthermore, the standards should be based upon what is safe for health, not an emotional belief that no constituents should be added to water. In New Mexico, nature adds constituents constantly, yet there is no harm to health unless concentrations become excessive.

Any standards adopted should be applied no closer to the tailings area than the company's restricted area, which depending on the location, may be the place of withdrawal for present or reasonably foreseeable future use. The constituents in water can only become a danger to health if the constituents exceed appropriate standards beyond the restricted area around the mill. Without these changes, EPA's standards will not be practicable for uranium mills operating in New Mexico.

2. The EPA proposed stabilization of tailings piles for 1,000 years with a minimum stabilization for 200 years is impracticable in New Mexico for several reasons:

(a) The New Mexico Board found that "at present levels of technology, no one can practicably provide erosion protection for a stabilized pile that confidently be predicted to last more than 200 years. (See, for example, the Greenleigh DOE to Seelander EPA letter of July 15, 1981..." (Board reasons, October 9, 1981, pg. 37-38). The Board adopted a 200 year stabilization performance standard for New Mexico. (12-300 B New Mexico Radiation Protection Regulations). Moreover, the Board reasoned that "testimony at the hearing indicated that stabilization measures providing protection for two hundred years were as stringent as need be required (*e.g.* Tr. at 483, 1059 and 1120...)".[2] The Board also provided that transport of radionuclides was not to exceed the applicable standards in Part 4 of the New Mexico Radiation

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2. Cited in support for this statement was testimony by Dr. Robely Evans a Professor of Physics Emeritus from MIT (faculty member from 1934-72) recipient of the AMA's Hull Gold Medal award, and one of the world's great experts on radiation. Dr. Evans also stated that there was no possible health effect from uncovered tailings but that they should be covered to prevent wind erosion but not because the tailings are a radiological hazard in terms of dust. Tr. volume 3, page 486.

Protection Regulations which are designed to protect public health. These standards are applied to tailings at operating mills in New Mexico and practicable.

(b) EPA states that "for an earth cover to provide reasonable isolation it should have a minimum of three meters thickness." (EPA's Regulatory impact analysis at 3-3). Testimony at the House of Representatives Committee on Armed Services on Management of Commingled Uranium Mill Tailings (HASC 97-55) shows that if the tailings in New Mexico "were to be covered with three or more meters of earth ..., this would require over 36 square miles (23,000 acres) to be denuded of soil." As New Mexico's Board found that stabilization for two hundred years is as stringent as needed, denuding and tearing up 23,000 acres of New Mexico for tailings stabilization is impracticable, unreasonable and EPA should not adopt such a regulation. There are no valid health reasons for requiring three meters of cover. Since the federal or state government will own the tailings, it can easily provide isolation by controlling access at far less cost.

3. We understand EPA proposes a 1000 year Stabilization criteria because it surmises the tailings covered for a lesser period will be misused. Tailings stabilized against erosion for a period of 200 years will not be subject to misuse in New Mexico for several reasons. First, the UMTRCA (§83) provides that upon stabilization, tailings are to be transferred to either the federal or state governments at the option of the site. There is every reason to believe that the government of the United States or the State of New Mexico will continue to protect the tailings. The United States government was formed and has lasted more than 200 years. Moreover, the Constitution is "designed to be permanent".[3] Additionally some form of government

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[3] Marbury v. Madison, 5 US (1 Cranch) 137 (1803).

has existed in New Mexico for hundreds of years through the governments of Mexico, Spain and the Pueblo Indians. If the tailings sites become the property of New Mexico, New Mexico protects its land against trespass and conversion of property. (Section 19-6-3 NMSA 1978.)

Additionally, the State of New Mexico has established a continued care fund to provide for preventing and remedying situations at the tailings. (Section 74-3-6 and 7, NMSA 1978). Each mill operating in the State must contribute to an interest bearing fund during operation a certain amount per pound of uranium concentrate fund to a maximum of a million dollars for each mill producing uranium. The amount of the fund is presently over five million dollars. New Mexico, therefore, has the funds to inspect, monitor and maintain the piles against erosion or against misuse in the future. New Mexico has significant land holdings protected and administered for future generations. The tailings piles will be simiilarily administered and will have a perpetually maintained fund to finance continued care.

WHEREFORE, IT IS HEREBY RESOLVED, that the New Mexico Radioactive Materials Committee opposes EPA's Proposed Standards for active site management during uranium mill processing operations and after the closure period of uranium mills, and in accordance with the Joint Memorial adopted by the 1983 New Mexico Legislature, supports New Mexico's uranium mill tailings Radiation Protection Regulations adopted by the New Mexico Environmental Improvement Board.

Joseph E. Hand
Chairman

James K. Otto
Vice Chairman

Robert M. Hawk

W S Eoff

Stephen A. Stoddard

Richard B. Vanderwagen

The Legislature
of the
State of New Mexico

36th Legislature, 1st Session

LAWS 1983

CHAPTER ______

SENATE JOINT MEMORIAL 15

Introduced by

SENATOR JOSEPH E. GANT
SENATOR W.S. EOFF
SENATOR STEPHEN D. STODDARD
SENATOR BARRY M. McADAMS

1912

A JOINT MEMORIAL

SUPPORTING THE REGULATIONS OF THE ENVIRONMENTAL IMPROVEMENT BOARD IN REGARD TO URANIUM MINE AND MILL TAILINGS.

WHEREAS, New Mexico is an agreement state with the nuclear regulatory commission (NRC) on the regulation of nuclear materials; and

WHEREAS, after more than three years of drafting, comment periods and public hearings, the environmental improvement board (EIB) approved uranium mine and mill tailings regulations that differ from NRC's regulations, but the EIB regulations are based on state-specific concerns rather than national-general concerns; and

WHEREAS, in August 1982, congress held hearings on the NRC regulations, and nine health physicists, including the past and current presidents of the American health physicists society, testified that the New Mexico regulations constitute a more appropriate solution to the problem of tailings disposition than the NRC regulations, and other professional persons also testified against the NRC regulations; and

WHEREAS, at the congressional hearing, NRC Commissioner Roberts committed NRC to the task of restudying its regulations, and the 1983 Domenici amendment mandated that the environmental protection agency (EPA) develop new radiation protection standards and that NRC base its tailings regulations on EPA standards; and

WHEREAS, the New Mexico EIB has determined that the following state-specific deviations can be made without harming either New Mexico citizens or the environment and, in fact, offer more protection in some cases:

NRC Regulations	New Mexico Regulations
(1) below-grade disposal of tailings is prime option	(1) below-grade disposal is one option, depending on the situation
(2) maximum possible flood	(2) 100-year flood event
(3) no degradation of groundwater	(3) comply with NM WQCC regulations
(4) stabilization of piles without active maintenance to preserve stability	(4) maintenance may be required, state protection through a continued care fund
(5) radon exhalation rate of 2 pCi/M^2/SEC	(5) radon concentration in air of 3 pCi/l
(6) minimum 3 meters cover	(6) design stabilization for 200 years
(7) prohibit self-insurance	(7) permit self-insurance under controls
(8) EPA 25 millirem rule for uranium mills	(8) excludes tailings piles as a source; and

WHEREAS, the environmental improvement board and division, the interim legislative radioactive waste consultation committee and the New Mexico congressional delegation have worked for three years to protect New Mexico's right to continued agreement state status and its right to regulate uranium tailings based on state-specific conditions;

NOW, THEREFORE, BE IT RESOLVED BY THE LEGISLATURE OF THE STATE OF NEW MEXICO that the legislature support the uranium mine and mill tailings regulations adopted by the environmental improvement board; and

BE IT FURTHER RESOLVED that copies of this memorial be sent to the environmental improvement board, the environmental protection agency, the New Mexico congressional delegation and the nuclear regulatory commission.

s/Mike Runnels
Mike Runnels, President
Senate

s/Juanita Pino
Juanita Pino, Chief Clerk
Senate

s/Raymond G. Sanchez
Raymond G. Sanchez, Speaker
House of Representatives

s/Stephen R. Arias
Stephen R. Arias, Chief Clerk
House of Representatives

ENERGY AND NATURAL RESOURCES

HOUSE JOINT MEMORIAL 19

36TH LEGISLATURE - STATE OF NEW MEXICO - FIRST SESSION, 1983

INTRODUCED BY

Vernon N. Kerr
Jerry Sandel
Don Silva
Boyd Scott
Hal Stratton
Stephen W. Kennedy
Robert M. Hawk

A JOINT MEMORIAL

SUPPORTING THE REGULATIONS OF THE ENVIRONMENTAL IMPROVEMENT BOARD IN REGARD TO URANIUM MINE AND MILL TAILINGS.

WHEREAS, New Mexico is an agreement state with the nuclear regulatory commission (NRC) on the regulation of nuclear materials; and

WHEREAS, after more than three years of drafting, comment periods and public hearings, the environmental improvement board (EIB) approved uranium mine and mill tailings regulations that differ from NRC's regulations, but the EIB regulations are based on state-specific concerns rather than national-general concerns; and

WHEREAS, in August 1982, congress held hearings on the NRC regulations, and nine health physicists, including the past and current presidents of the American health physicists society, testified that the New Mexico regulations constitute a more appropriate solution to the problem of tailings disposition than the NRC regulations, and other professional persons also testified against the NRC regulations; and

WHEREAS, at the congressional hearing, NRC Commissioner Roberts committed NRC to the task of restudying its regulations, and the 1983 Domenici amendment mandated that the environmental protection agency (EPA) develop new radiation protection standards and that NRC base its tailings regulations on EPA standards; and

WHEREAS, the New Mexico EIB has determined that the following state-specific deviations can be made without harming either New Mexico citizens or the environment and, in fact, offer more protection in some cases:

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(7) prohibit self-insurance	(7) permit self-insurance under controls
(8) EPA 25 millirem rule for uranium mills	(8) excludes tailings piles as a source; and

WHEREAS, the environmental improvement board and division, the interim legislative radioactive waste consultation committee and the New Mexico congressional delegation have worked for three years to protect New Mexico's right to continued agreement state status and its right to regulate uranium tailings based on state-specific conditions;

NOW, THEREFORE, BE IT RESOLVED BY THE LEGISLATURE OF THE STATE OF NEW MEXICO that the legislature support the uranium mine and mill tailings regulations adopted by the environmental improvement board; and

BE IT FURTHER RESOLVED that copies of this memorial be sent to the environmental improvement board, the environmental protection agency, the New Mexico congressional delegation and the nuclear regulatory commission.

STATE OF NEW MEXICO
NEW MEXICO LEGISLATIVE COUNCIL
334 STATE CAPITOL, SANTA FE, NEW MEXICO 87503
Telephone 505 827-3700

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Rep. Hoyt Pattison
Rep. Judith A. Pratt

LEGISLATIVE COUNCIL SERVICE
Clay Buchanan, Director
Richard H. Folmar, Assistant Director

COPY

June 17, 1983

File No. 200.2

Mrs. Mary Whitman
Governor's Office
Low Level Waste Studies Director
157 State Capitol
Denver, Colorado 80203

Dear Mrs. Whitman:

Representative James Otts has requested that I send you a copy of Senate Joint Memorial 15 adopted last session by the New Mexico legislature.

The memorial passed the senate by a vote of 32-0 and the house by a vote of 58-1. It was introduced by senate members of our joint interim committee.

During the three years preceding its introduction, the committee held several meetings on the subject of the disposition of uranium mine and mill tailings, including one trip to the sites near Gallup.

The committee and the previous administration were in accord that the regulations our environmental improvement board had adopted for New Mexico, as an agreement state, provided a far more reasonable and practical approach to the disposition problem than proposed federal regulations. This conclusion was reached only after many hearings and testimony from state, federal (DOE) and private industry experts.

It was with some surprise that the committee learned of recent efforts of certain advisors on our present governor's staff urging the rejection of our state regulations and the adoption of stringent NRC regulations. Such a position was deemed even more surprising to the committee in the light of the 1983 expression of intent by the legislature.

In addition to the senate joint memorial, I am enclosing a copy of the most recent report of the interim committee.

Sincerely yours,

RICHARD H. FOLMAR
Assistant Director

RHF/mg

Encs.

LEGISLATIVE COUNCIL
Rep. Raymond G. Sanchez, Co-Chairman
Sen. I. M. Smalley, Co-Chairman
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Richard H. Folmar, Assistant Director

STATE OF NEW MEXICO
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July 25, 1983

File No. 205.87-83

The Honorable Pete V. Domenici
4239 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Senator Domenici:

The Radioactive Materials Committee appreciates the opportunity to submit an additional statement for the record of your July 6 hearing in Albuquerque.

The committee, speaking on behalf of the New Mexico legislature and the legislative intent as expressed by Senate Memorial 15 of the 1983 session, unanimously stands in opposition to the Environmental Protection Agency's proposed standards for active site management during uranium mill processing operations and after the closure period of uranium mills.

The Radioactive Materials Committee is genuinely concerned that such EPA standards, as well as Nuclear Regulatory Commission regulations, are based on general and national concerns rather than site-specific reality as it exists in New Mexico. It is for this reason that the legislature and the committee endorse the regulations adopted by the state's Environmental Improvement Board after more than three years of drafting, comment periods and public hearings.

These regulations were adopted in New Mexico's capacity as an agreement state with the NRC on the regulation of nuclear materials. You will remember that the Congress held hearings in August of 1982* on the NRC regulations and nine health physicists, including two past presidents of the American Health Physicists Society, testified that the New Mexico regulations constitute a more appropriate solution to the problem of tailings disposition than the NRC regulations. Similar testimony was received against the NRC regulations by other professionals.

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*"Management of Commingled Uranium Tailings", Hearings before the Procurement and Military Nuclear Systems Subcommittee of the House Committee on Armed Services, August 17-18, 1982 (H.A.S.C. No. 97-55).

Prior to January 1, 1983, the Radioactive Materials Committee itself conducted a series of hearings pertaining to mill tailings regulations and arrived at a similar conclusion: that the EIB regulations offered a more practical approach than did the national standards and regulations and afforded ample protection to the health and safety of our citizens. The committee made on-site visits to the areas concerned.

Throughout this period of hearings, the previous state administration and the committee were completely in accord on the approach that should be taken to the mill tailings disposition problem. It was, therefore, with some surprise that the committee learned recently of the present state administration's apparent reversal of this position by disavowing existing state regulations and demanding stricter federal regulation. To our knowledge, this position was taken without public hearing or professional and scientific input and completely disregards testimony and findings of hearings during the previous three years.

The Radioactive Materials Committee and the New Mexico State Legislature emphatically do not support this apparent position of the state administration.

The committee earnestly solicits your aid in support of New Mexico's uranium mill tailings radiation protection regulations adopted by the New Mexico Environmental Improvement Board.

Very truly yours,

Joseph E Gant

Senator Joseph E. Gant, Chairman

James K. Otts

Representative James K. Otts, Vice Chairman

W S Eoff

Senator W. S. (Smitty) Eoff

Robert M. Hawk
Representative Robert M. Hawk

Vernon N. Kerr
Representative Vernon N. Kerr

Harry M. McAdams
Senator Harry M. McAdams

Don Silva
Representative Don Silva

Stephen D. Stoddard
Senator Stephen D. Stoddard

Richard B. Vanderwagen
Representative Richard B. VanderWagen

State of New Mexico
House of Representatives
THIRTY-SIXTH LEGISLATURE
Santa Fe

VERNON N. KERR
LOS ALAMOS & SANDOVAL COUNTIES
District 43
113 SHERWOOD BLVD.
Home Telephone: 672-3782
Business Telephone: 667-2334
LOS ALAMOS, NEW MEXICO 87544

COMMITTEES:
Member:
ENERGY & NATURAL RESOURCES
TRANSPORTATION

17 July 1983

TO: Senator Pete V. Domenici and Secretary William Ruckelshaus

RE: Additional testimony related to the Albuquerque hearing of 6 July 1983 in regard to Uranium Mill Tailings Disposal.

State Senator Stephen D. Stoddard and myself, State Representative Vernon N. Kerr, were present at the Albuquerque hearings as members of the New Mexico State Legislative Radioactive Materials Committee (RMC). Our combined experience with radioactive materials approaches sixty years as employees of the Los Alamos National Laboratory.

Other members of the Committee are businessmen with interests in mining, mine supply, radio, ranching and a long time employee of Sandia National Laboratory.

Over the five year lifetime of the Committee we have developed quite a degree of expertise in matters of concern to the Committee. During this period we have pursued an active, cooperative role with the state administrations in power. That is until the present time.

When the Federal Uranium Mill Tailings Legislation was enacted we brought in both federal and state agency people to review its provisions. Since then we have worked, argued, and persuaded to convince state agency people to promulgate reasonable rules and regulations to care for uranium mill tailings. We have been pleased not only that the New Mexico Environmental Improvement Board has promulgated reasonable rules but also that these same rules, regulations and standards could become models for the Environmental Protection Agency and the Nuclear Regulatory Commission to consider.

We are concerned that differences between the Legislature and the present Administration of the State of New Mexico may not be evident.

During the 1983 Legislative Session, Senate Joint Resolution 13 was passed by a wide margin in both houses. This resolution has been submitted in the record of the Albuquerque hearings along with a resolution which the Radioactive Materials Committee adopted at its June meeting. Both expressed strong support for the Environmental Improvement Board adopted standards.

We are submitting with this letter a packet of materials which we believe shows a diametrically opposite point of view which is being pursued by our State Administration and that, one, which we do not wish to have shown as representing a reasoned viewpoint of the entire state of New Mexico.

The April 6 memo to members of the Sub-Cabinet on the Environment recommends the change in the state's support of its own regulations. A following letter dated April 11 from the Governor disowns state regulations. Next the recent July 11 and 15 newspaper articles show the extent to which contrary viewpoints are being purged from the state's regulatory agency, and the Environmental Improvement Board.

A note from Dr. Hal O'Brien (who testified at Albuqueruqe) to me introduces several pages of proposed letters to Mr. Ruckelshaus which suggest that more stringent regulations and standards be adopted than those proposed to EPA. (This could cost the Federal Government and the states millions more dollars than is warranted by health based regulations and standards such as those suggested by New Mexico's Environmental Improvement Board.) These letters, one addressed to Mr. Administrator and another to Mr. Ruckelhaus are to be backed up with a technical review. This review as prepared by Mr. Millard is flawed and does not agree with earlier testimony before the EPA as presented by Gerald W. Stewart on June 14, 1983 in Denver. Mr. Stewart's statements reflect the official view of the state's Environmental Improvement Division and they coincide with the views of the Radioactive Materials Committee.

Finally, we are submitting, as an overview with which we substantially agree, a letter by Frank McGuire of New Mexicans for Jobs and Energy. This latter piece is one that should already be in the Agency's files.

I would like to stress that Senator Stoddard and myself feel strongly that a distorted picture of New Mexico's approach to environmental problems should not be held extant and that a proper picture be held by the EPA and Senator Domenici.

Vernon N. Kerr

Vernon N. Kerr, State Representative
District 43

Stephen D. Stoddard

Stephen D. Stoddard, State Senator
District 23

State of New Mexico
Office of the Governor
Santa Fe
87503

Toney Anaya
Governor

April 6, 1983

MEMORANDUM

To: Members of Sub-Cabinet on the Environment

From: Sally Rodgers

Re: Uranium Mill Tailings Remedial ~~-~~Actions Project (UMTRA) and related issues

The Department of Energy has designated two sites in New Mexico Ambrosia Lake and Shiprock, for remedial clean-up under the provisions of the Uranium Mill Tailings Radiation Control Act of 1978.

The Ambrosia Lake site is the only New Mexico site which is eligible for the 90/10 cost sharing authorized by the federal act. DOE has given the site a medium priority status.

The Shiprock site is in the high priority category and it also differs in categorization by being eligible for 100% federal funding.

DOE wants to begin negociations on the remedial action agreement by mid-May. Their target for completion is July.

The following are states which have either completed or are in the process of negociating their remedial action agreements: Colorado, Wyoming, North Dakota, Idaho, Oregon, Texas, Pennsylvania and the Navajo Nation.

Recommendations:

1. Discussion, with recommendations to the Governor, of a negociating officer for the State.
2. Assignment of responsibility to contact other states which have or are negociating their agreements.
3. Consideration of a format in which the Governor can take the lead on uranium mining and milling and nuclear waste issues in the western states. We are definitely behind Colorado right now in uranium mining and milling issues.

STATE CONTACTS

COLORADO: Mary Whitman, Governor's office (303) 866-2471
Al Hazle - Director of Radiation Control Division
Colorado Department of Health, Denver
Richard Griffith - Assistant Attorney General, Natural
Resources section - Denver

** The Colorado AG has prepared a memo which we should request on the tailings clean-up program which argues that states have the power to make criteria stricter than the feds. They are applying strigent standards for both remedial and active site programs. They appear to have a stronger posture and program than New Mexico and their experience, in particular, may be of value to us in our negociations with DOE.

WYOMING: Nancy Frudenthal, Governor's Office (307) 777-7437

UTAH: Juliene Christopherson - Governor's Office
Salt Lake City

** Hearings were just held on their tailings pile

Emily Chares- Governor's office - administrative assistant for human resources and legislation. She worked on coordinating hearings for Utah fall-out victims.

TEXAS: Myra McDaniels - Governor's office

NAVAJO NATION: Claudine Arthur (602) 871-4941

RELATED ISSUES

LITIGATION PENDING ON ACTIVE AND INACTIVE TAILINGS PILES REGULATIONS

INACTIVE (EPA)

Two cases have been consolidated by the 10th circuit court of appeals: 1. American Mining Congress v Gorsuch/EPA #831014 2. United Nuclear Corp. v Gorsuch/EPA #831041. The issue in both cases has been industry's petition to EPA to further weaken EPA standards for inactive tailings piles clean-up. The Environmental Defense Fund, Sierra Club, Natural Resources'Defense Council and SOuthwest Research and Information Center filed their own petition for review of EPA standards arguing the other side of the issue -- that the standards are too weak. All three petitions have been consolidated under #831014.

The states of Colorado and Wyoming have intervened in opposition to industry's petition.

RECOMMENDATION: Research the basis of Colorado and Wyoming's interest to determine if they coincide with New Mexico's with subsequent possible petition by New Mexico to intervene with our sister states for stronger standards.

The attorney representing the environmental groups is ROger Beers (NRDC) 415-861-1400

RELATIONSHIP TO URANIUM MILL TAILING REMEDIAL ACTION PLAN (UMTRAP):

Intervention by the state could strengthen our negociating position for more stringent clean-up standards.

ACTIVE (NRC)

Kerr-McGee, et. al. v NRC, 1981 -- now pending before the 10th Circuit Court of Appeals. Kerr-McGee is basically challenging the NRC regulations on aCtive tailings piles as being too stringent.

The state of New Mexico has testified in an amicus brief that the NRC regulations governing active mill operations are "arbitrary and capricious", and further that radiation risks were minimal and the regulations should be revoked. The court upheld the NRC regulations as valid in March, 1982, the full court, however, vacated its decision in October 1982 and ordered the case reheard. To my knowledge, no trial date has yet been set.

The state has practiced what it preached in its amicus brief by promulgating its own set of regulations of uranium mill operations and tailings which are considerably weaker than NRC's. It should be noted that as an agreement state, New Mexico's regulations are to be "equivalent or more stringent"than the NRC regulations. The NRC has not approved New Mexico's regulations (adopted 11/81) because they fail to meet that standard.

The state's regulatory action has served to further compound the issue because our regulations are being used as a "model" by Union Carbide Corporation in its petition to the NRC to amend its uranium licensing regulations.

Note: The states of Washington, Texas and Colorado have adopted the more strigent October 1980 NRC regulations and environmental conditions in those states are not appreciably different than our own.

Recommendations:

1. Withdraw as amicus in the Kerr -McGee suit or alternatively
2. Change the state's position to support the NRC regulations.
3. The Governor could request the Environmental Improvement Board to review our mill tailings licensing regulations with a view towards strengthening them. (This latter action would almost certainly require a number of changes on the board as well as a change in perspective with the Environmental Improvement Division - specifically within the Radiation Protection Bureau).

STATE OF NEW MEXICO
[illegible]
SANTA FE
[illegible]

TONEY ANAYA
[illegible]

April 11, 1983

John Philips, Chief
Rules and Procedures Branch
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Philips:

The offices of the Governor and the Secretary of Health and Environment have been involved in a close review of the New Mexico radiation and mill tailings regulations since our letter of January 27, 1983.

Our findings indicate room for improvement in our regulations. Towards that end, I have decided to create a small working group of technical experts to further evaluate the record and the process of assuring health, safety and environmental protection. Upon completion of their work and our evaluation, we will present our findings and recommendations to the New Mexico Environmental Improvement Board, the legal entity in New Mexico empowered to adopt and promulgate regulations, for their determination of the measures necessary to strengthen our regulations.

This is, of course, above and beyond the Union Carbide Corporation petition for rulemaking. We are however, reviewing our regulations for our own reasons. We are aware that Senator Domenici's amendment to the Uranium Mill Tailings Control Act of 1978 affords the state more time for its review." Hence, we do not see the need for a final determination on our part at this time.

It is our considered judgement that, with our review process yet to be completed, it would be unwise to set rules for other states based on New Mexico's regulations.

Sincerely,

TONEY ANAYA
Governor

TA/lap

cc: Robert McNeill, Secretary, Health and Environment
Russell Rhodes, Director, Environmental Improvement Division [illegible]
Phillenore Howard, Environmental Improvement Board Sierra Club, new appointment
George Hensley, Environmental Improvement Board - [illegible]
Ella Hyatt, Environmental Improvement Board
Roy Walker, Environmental Improvement Board
William Atkins, Environmental Improvement Board

[illegible]

~~From: [illegible]~~

TO: SAlly RODGERS

FR: DAVE MCKINNI

Dear Mr. Administrator:

We are writing to express our continuing concern over the implementation by the Environmental Protection Agency (EPA) and the Administration of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). Although the Act has been in effect for 4-1/2 years, not a single contaminated site has been cleaned up nor have citizens in uranium mining districts throughout the West been assured that the regulatory program required by the Act to protect them and their environment from further hazard will be put in place.

We appreciate the eventual decision by the Agency to hold a hearing in the West as part of its pending rulemaking to establish final tailings disposal standards for active uranium mills. We wish, however, to take this opportunity to reiterate the special concern that our Western states have over the level of protection and regulation the EPA has proposed for both inactive and active uranium mill sites.

On January 5, 1983, the EPA issued its final standards for the cleanup of inactive uranium mill tailings under the Uranium Mill Tailings Remedial Action Program (UMTRAP) authorized under Title I of UMTRCA. These standards are significantly less stringent than the interim standards promulgated by the Agency in January of 1981. A legal suit has been filed against the EPA contesting these standards, with Colorado and Wyoming joining to seek their replacement with more stringent requirements.

On April 29, 1983, EPA proposed standards for active uranium mill tailings disposal. Those standards are less stringent than the approach taken by the EPA in Title I interim standards. The proposed standards are also less protective than the active uranium mill standards promulgated by the U.S. Nuclear Regulatory Commission in several key respects. These proposed EPA standards fail, in our view, adequately to address a range of uranium mill tailings disposal problems that confront our citizens. These include:

1) Excessive Risk Levels--The Title I EPA regulations for the UMTRAP sites set a standard that would allow an additional three cases of cancer in every 100 contaminated houses, amounting to a doubling in the rate of lung cancer. Under the proposed Title II regulations for active sites, EPA would allow a release of

radioactive radon gas approximately 20 times the normal rate of background radiation. The interim standards promulgated by the EPA in 1981 set a standard of only twice background.

Allowing a public exposure of up to 20 times the normal exposure to a hazardous pollutant is a radical departure from this Nation's practice of minimizing such exposures. By contrast, nuclear power plants are required to limit exposures to the public to one one-thousandth of background radiation.

2) Minimal Longevity Requirement--The proposed active site regulations require stabilization and containment of uranium mill tailings for as little as 200 years. The EPA has identified the hazard from uranium mill tailings as extending for a period of hundreds of thousands of years. The EPA's interim standard required control for "at least 1000 years" and the NRC's regulations require control for "thousands of years".

EPA's retreat from a minimum 1,000--year design standard to a 200-year is based on a selection of a "cost-effective" alternative with a presumption that the effectiveness of the controls would last longer. The proposed 200-year minimum requirement, however, provides a containment period neither appropriate to the length of the hazard nor long enough to assure use of long-duration control measures.

3) Groundwater Protection--The UMTRCA requires the Agency to establish uranium mill tailings standards consistent with the provisions of the Solid Waste Disposal Act. The Agency, in keeping with this requirement, has appropriately incorporated RCRA groundwater protection requirements. These requirements would assure that groundwater would not be degraded. The regulations are predicated, however, on an Agency position that contamination of groundwater ceases with active mill operation. It therefore leaves open the problem of post-closure groundwater protection except for the unacceptable implication that active remedial measures, as used under RCRA, would be applicable. As the Agency has repeatedly stated, active institutional controls cannot, and should not, be relied upon.

4) Clean Air Act Application--The EPA must, under Section 122 of the Clean Air Act, regulate hazardous radioactive air pollutants. A court has ordered it to do so. The EPA is currently engaged in a rulemaking to promulgate standards for radioactive air pollutants including radon from uranium mines. Our concern lies with the failure of the Agency to incorporate, in a unified standard, its regulatory authority to control radon and other radioactive air pollutants released from uranium mill tailings. Since the EPA has listed radon as a hazardous pollutant under Section 112 of the Clean Air Act, we believe it is required to fulfill the requirements of both the Clean Air Act and UMTRCA in regulating mill tailings. In particular, it must consider the cumulative impacts from multiple sources and conformance with the health-based standard setting process required under the Clean Air Act.

5) Standards for "Remote Sites"--The EPA has proposed setting less stringent standards for both inactive Title I sites and active sites that are located in sparsely populated areas. We categorically reject the premise that the EPA should base standards for a hazard that may last for thousands of years upon current populations. As representatives of Western states, which continue to experience rapid population growth and changing development patterns, we are especially concerned that the EPA proposes to set uranium mill tailings standards on a site specific basis simply because of low population density in the immediate vicinity of the site. Current population does not provide an adequate basis, beyond a matter of a few decades, for determining risk even to nearby populations.

The EPA is also constrained by legal requirements upon it, whether under the UMTRCA or the Clean Air Act, to protect the general public from the additional, although small, doses it will receive from mill tailings regardless of their location. The EPA is also constrained from setting separate standards for remote sites by the need to protect ground and surface water from both radiological and non-radiological contaminants. We do not believe that citizens should be exposed to a greater level of pollutants merely because they live in a rural and sparsely populated area.

Recognizing the costly task of cleaning up the UMTRAP sites, we still must insist that standards implemented by the EPA assure that such remedial action will be done correctly the first time and will not require future remedial action because of the inadequacy of initial cleanup efforts. We strongly believe that reasonable preventive methods will cost far less than remedial ones. Thus, the standards for active milling operations must assure that the tailings will not present future cleanup problems. We must conclude that a 200-year design requirement is not a cost effective approach in either the long or short terms.

The States of Colorado and New Mexico have concluded that EPA's final standards for the cleanup of inactive uranium mill tailings and its proposed standards for active mill tailings operations would inhibit their ability properly to safeguard the environment and the health and safety of their citizens. The standards favor short-term measures over a permanent solution. Consequently, they will result in the waste of millions of dollars and likely will leave future generations to face the same or perhaps increased problems.

We urge you to conduct a review of the standards the EPA has promulgated for the UMTRAP sites as well as of pending proposals to develop less stringent standards for those inactive sites located in sparsely populated areas. We believe the public health and safety, and the environment, can be better served by the re-promulgation of more stringent EPA standards.

We also urge you to give your personal attention to the development of standards for the active uranium mill tailings sites now underway within the Agency. We understand the EPA is under an October 1, 1983 statutory deadline to promulgate final standards. We believe, however, the EPA should address, prior to the October 1 deadline, the deficiencies in the proposed regulations discussed in this letter. Such action could considerably enhance your efforts to recapture EPA's lost momentum in the battle to protect the Nation's environment, as well as to establish a cooperative relationship with states.

Sincerely yours,

Richard D. Lamm
Governor
State of Colorado

Gary Hart
United States Senator
State of Colorado

Toney Anaya
Governor
State of New Mexico

Jeff Bingaman
United States Senator
State of New Mexico

STATE OF NEW MEXICO
OFFICE OF THE GOVERNOR
SANTA FE
87503

TONEY ANAYA
GOVERNOR

MEMORANDUM

To: Bob McNeill

From: Governor Anaya

Re: Proposed EPA standards on active and inactive uranium mills

The enclosed letter to William Ruckelshaus from myself and other Western Governors represents the policy direction I wish to pursue in this area. It is probable that litigation will follow the adoption of EPA's standards and I want to insure that the State of New Mexico is on record supporting the principles outlined in the Ruckelshaus letter in the event the state's interests dictate a challenge to the standards.

Jere Millard, of your staff, is known to me for his scientific objectivity and integrity and therefore, I would like you to assign to him the responsibility of preparing the state's comments on EPA's proposed standards. He should submit these comments directly to you. The comment deadline is June 30.

Mr. William Ruckelshaus
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20406

Dear Mr. Ruckelshaus:

On January 5, 1983, EPA issued its final standards for cleanup of inactive uranium mill tailings under the Uranium Mill Tailings Remedial Action Program (UMTRAP). On April 29, 1983, EPA proposed standards for active uranium mill tailings. Both standards will provide inadequate control over uranium mill tailings.

As the principal states in which UMTRAP sites and active uranium milling activities are located, Colorado, New Mexico, Utah and Wyoming strongly protest the lack of stringent regulation of uranium mill tailings and the hazards they present. Legal suit has already been filed against the UMTRAP standards, with Colorado and Wyoming joining to seek the replacement of those standards with more stringent ones. Similar action will undoubtedly take place if EPA finalizes its active tailings standards in their present form.

EPA's active and inactive uranium mill tailings standards indicate a clear disregard for adequate environmental protection. Among the health and environmental consequences of the final UMTRAP standards and proposed active tailings standards would be:

1. The allowance of an additional three cases of lung cancer in every 100 contaminated houses, amounting to a doubling in the rate of lung cancer.

2. The allowance of the radioactive radon gas release rate to be 20 times more than is normal. (The proposed UMTRAP standards would have limited the release rate to about twice background levels.)

3. The elimination of more than half of the known contaminated areas within UMTRAP communities from cleanup eligibility.

4. The stabilization of mill tailings for as short as 200 years. (The proposed UMTRAP standards required stabilization for "at least 1,000 years.")

Allowing people to be exposed to 20 times the normal level of radiation is a radical departure from this nation's long-held priority of cancer prevention. Nuclear power plants are required not to emit more than one one-thousandth of the radiation to which the average person is now exposed. By contrast, the EPA standards would allow uranium mill tailings to release 20 times more radiation than background.

EPA's retreat from a minimum 1,000-year design standard to 200 years is based on the premise that the federal government would control the sites and forbid access, thereby enabling less stringent standards to be applied. However, EPA has admitted that long-term institutional control is improbable, noting in its explanation of the final UMTRAP standards that, "We know no historical examples of societies successfully maintaining active care of decentralized materials through public institutions for periods extending to many hundreds or thousands of years." In spite of this admission, EPA's standards require such control for the hundreds of thousands of years during which the uranium mill tailings must be isolated from the environment.

Faced with the costly task of cleaning up the UMTRAP sites, we must insist that standards assure that such remedial action will be done correctly the first time and will not require future remedial action because of the inadequacy of initial cleanup efforts. Likewise, we are convinced that reasonable preventive methods are far less costly than remedial ones, and thus standards for active milling operations must assure that the tailings will not present future cleanup problems. Two hundred-year designs are not cost effective either in the short or long term and maintenance and repair costs on such sites can be overwhelming.

The States of Colorado, New Mexico, Utah and Wyoming have concluded that EPA's final standards for the cleanup of inactive uranium mill tailings and its proposed standards for active mill tailings operations would inhibit their ability to properly safeguard the environment and the health and safety of their citizens. The standards favor short-term measures over a permanent solution, which will result in the waste of millions of dollars and leave future generations with the probability of facing the same or perhaps increased problems.

Rather than to continue costly and divisive court battles, the public health and environment can be much better served with the revocation and repromulgation of more stringent UMTRAP standards. In the case of the active tailings standards, we understand

EPA is under an October 1983 deadline to promulgate final standards; however, there appear to be administrative means whereby those standards could be strengthened, as we believe is necessary, lin time for the October deadline and yet provide for their further refinement subsequent to the deadline. Your efforts to recapture EPA's lost momentum in the battle to protect the nation's environment, as well as to establish a cooperative relationship with states, could be considerably boosted by such action.

We are anxious to see the re-emergence of EPA as a strong environmental force, which we hope can be reflected in the repromulgation of stringent uranium mill tailings standards.

Sincerely,

Richard D. Lamm
Governor
State of Colorado

Ed Herschler
Governor
State of Wyoming

Scott Matheson
Governor
State of Utah

Toney Anaya
Governor
State of New Mexico

TECHNICAL REVIEW
PROPOSED EPA STANDARDS
40 CFR 61
40 CFR 192

1. Radium In Soil

The proposed 5 pCi/g limit for Ra-226 concentration in the top 15 cm of soil around an active or inactive uranium tailings pile appears to be reasonable and a workable standard. Although this level is approximately 5 times the crustal average of the earth, it would adequately protect public health following cleanup to this soil concentration. Even though this standards is not a primary health standard it is based upon health protection criteria consistent with the Federal Radiation Council and International Commission on Radiological Protection (ICRP) concepts of limiting whole body dose to 500 mrem/y. A recent study at the Los Alamos National Laboratory also lends support to this proposed limit in concluding that 3 pCi/g was the appropriate Ra-226 soil limit.

It should be noted that field measurements would be difficult to perform for the 5 pCi/g level proposed, but this in itself, would not justify raising the standard. Since apropriate field sampling techniques are available, EPA should specify how such sampling should be implemented to provide a representative Ra-226 average concentration rather than requiring a general Ra-226 value for a 100 m^2 area. This would be of particular concern if tailings were scattered or buried below the surface. By requiring a set statistical confidence limit for the mean Ra-226 value obtained, it could be insured that a sufficient number of soil samples were collected from a given area.

2. Radon Flux

There are great difficulties in measuring radon flux as evidenced by large radon and systematic errors. EPA may have relaxed the initially proposed flux standard of 2 pCi/m^2s in an attempt to overcome such measurement difficulties. However since large systematic errors are observed in measuring radon flux, raising the flux standard will not improve the realiability of collected data and is therefore not justified. If EPA views the flux standard strictly as a design criterion then, the 20pCi/m^2s level is appropriate when consideration of cost resulting from a 2 pCi/m^2s standard is taken into account.

EPA has correctly stated that a flux standard is the most direct way to ensure an adequate earthen cover and proper stabilization for long periods of time. However, a secondary ambient radon concentration standard as proposed for inactive tailings piles should be strictly enforced as a performance standard and verification of accomplished remedial action. Unfortunately, the radon concentration standard of 0.5 pCi/l that is proposed, takes effect at the tailings disposal site boundary. This would enable industry to comply by simply extending the boundary over a large area and rely on dispersion to achieve compliance without regard to control of the primary source. EPA should therefore adopt sufficient language to prevent such extension of the boundary which would necessitate control of a large area for long periods of time. In addition, since institutional controls have a limited effective life time, it must be recognized that sufficient stabilization must anticipate nearby public occupancy.

EPA should maintain a consistent viewpoint regarding emission standards such as radon flux. In 40 CFR 61 EPA stated that they would not regulate radon emissions from uranium mines but then proposes to control radon from tailings piles with a flux standard. Additionally, the 0.5 pCi/l standards proposed for inactive tailings piles is not consistent with the 0.2 pCi/l proposed for uranium mines or with the existing 3 pCi/l standard for active mills. Since EPA has exempted the uranium fuel cycle in 40 CFR 61 covered by 40 CFR 190 regulations, and 40 CFR 190 exempts radon and radon daughters, EPA has ignored radon limits for active uranium mill tailings and failed to fulfill its regulatory authority. EPA states that the current 10 CFR 20 NRC regulations control radon in unrestricted areas where more than a few people live to 1 pCi/l, thus resulting in an incremental life time risk for lung cancer of 2 in 1,000. Such a risk is unacceptable and far from agreement with recommendations concerning acceptable risk to members of the general public as stated in the International Commission on Radiological Protection's Report 26.

One further comment should be made in response to EPA's contention on page 19588-A. That the dose to human bone from Pb-210, Th-230 and Ra-226 ingestion is small. The perennial release of radon into the airshed around a given facility may very well lead to significant human bone dose from ingestion of radon daughter products via the meat pathway. The state of New Mexico has recently funded a $90,000 project to determine such impacts on man's food chain.

3. Working Levels

EPA has proposed that radon decay product concentrations including background not exceed 0.03 working levels (WL) and reasonable effort should be made to not exceed 0.02 WL in any "occupied or habitable building". Since these could easily be a suitable sample of a population present in such a building, current NRC regulations would be 0.01 WL. Background WL values have been reported in the literature as 0.005 WL. Therefore, the EPA proposal of 0.2 WL would correspond to 0.015 WL above background or 3 pCi/l of radon at 50% equilibrium. This proposed EPA regulation is therefore less stringent than the current NRC regulation and is not in accordance with acceptable risk recommended by ICRP-26. EPA should therefore consider a reduction in the proposed WL standard.

4. Longevity Requirements

EPA has stated that a 200-year design standard is sufficient to control radiological hazards from tailings piles but effort should be made to achieve a 1,000 year design. No justification is offered for this difference of a factor of 5 for design standards. EPA should present evidence that 1,000 years is not achievable in order to justify a less stringent design standard. A 200-year design standard is inadequate in addressing radiological hazards associated with uranium tailings piles and may necessitate costly long term remedial actions to ensure adequate stability of the pile. EPA states on page 19598 that "we are aware of no historical examples of societies successfully maintaining active care of decentralized materials through public institutions for periods extending to many hundreds or thousands of years and "We have concluded that primary reliance on passive measures is preferable, since their long-term performance can be projected with more assurance than that of measures which rely on institutions and on continual expenditures for active maintenance." Based on this view point and the long-term radiological hazards to be controlled, EPA should retain their original proposal for a minimum 1,000 year design standard.

5. Artificial Liners

EPA has stressed the concept of non-degradation of groundwater quality resulting from seepage of tailings pile contaminants. Because of this stance, EPA has advocated use of artificial liners during the active lifetime of the pile. EPA should consider use of natural liners in conjunction with artificial liners. It is apparent that EPA assumes that contamination of groundwater will discontinue upon cessation of active milling operations. This contention is certainly not true as evidenced by the substantial amount of tailings liquids still present on top of the inactive Ambrosia Lake pile. The bimodal distribution of sands and clays may very well not allow enough surface evaporation to occur and therefore, groundwater contamination will continue following active operations. It is, therefore, not possible to estimate or assume that a tailings pile will dry out adequately based on pan evaporation rates. Great difficulties experienced in cleaning up contaminated groundwater at the UNC Church Rock facility in New Mexico lends strong support to the non-degradation position espoused by EPA. In addition, post closure contamination needs to be more adequately addressed.

Limiting groundwater contamination to drinking water standards for Ra-226, Ra-228, and gross alpha radioactivity also adheres to a non-degradation concept, but fails to allow uncontaminated natural groundwater quality which could easily exceed the proposed standards. It is also questionable whether drinking water standards are necessary for this type of groundwater use.

6. Uranium Mine Emissions

New Mexico has conducted extensive radon monitoring around uranium mining and milling areas which demonstrated that uranium mine vents are a very significant source of radon emissions. In this regard, there is agreement that the proposed EPA standard to regulate radon from underground mines is necessary. An attached draft publication entitled Radon and Radon Progeny Concentrations In New Mexico's Uranium Mining and Milling District is attached for your information.

EPA has proposed limiting annual average radon air concentrations due to emissions from underground uranium mines to 0.2 pCi/l above background in an unrestricted area. It is also clear that EPA intends to calculate this radon air concentration using radon emission data and dispersion relationships. Current field instrumentation can determine radon concentrations below the proposed limit and thus adequately determine non-compliance by direct measurement. EPA should therefore consider placing more emphasis on measured values rather than modeled ones to ensure adequate protection of the public health.

Background radon concentrations in New Mexico's Grants Mineral Belt have been reported by a variety of investigators and ranges from 0.13 ± 0.03 to 0.25 ± 0.005 pCi/l. Thus, the proposed radon limit would roughly double the background radon air concentration. Since this limit is exclusive of background contributions, background radon measurements would also have to be determined if measured values were used. Consideration of a standard including background should therefore be initiated since this would greatly reduce monitoring costs and difficulties in determining background levels in areas with multiple sources and previously impacted environments. Most importantly, health effects are obviously a function of total radon concentrations including background contributions.

The magnitude of the proposed EPA radon limit is quite restrictive but appears reasonable based on ICRP 26 recommendations regarding acceptable risk. For example, 0.2 pCi/l at 100% equilibrium would be equivalent to 0.1 working level months (WLM) or a lung cancer risk of 10^{-5} cancers/year using a risk estimate cited by Evans et. al. as 100 x 10^{-6}. Since all levels of radon exposure have some incremental associated health risk, the burden of proof should be placed on industry to show why a particular level of exposure cannot be met. This concept is embodied in the ALARA (as low as reasonably achievable) principle and ICRP 26 which states that every radiation exposure must be accompanied by some justification such as a "net positive benefit". Additionally, a low radon standard should be adopted despite, for example, inadequacies of measuring health effects by epidemiological methods.

7. General Comments

EPA needs to address regional impacts from multiple sources as is the case in Ambrosia Lake, New Mexico and not just impacts from single sources.

Consideration should be given to the incorporation of language to prevent all discharges to surface waters not regulated by NPDES permits. By stating that such discharges are not to surface waters of the United States, operators have been able to avoid NPDES regulation. Correct language should state that unrestricted release to surface drainage basins must be regulated.

EPA has failed to recognize the long term hazards and relative importance of continual discharge of mine waters to surface drainages. Such discharges in New Mexico have created artificially perennial streams accompanied by increased domestic animal usage not possible under natural conditions. Analysis of the Church Rock spill in New Mexico pointedly brought to light the importance of the water-meat ingestion pathway associated with the discharge of mine dewatering effluents. Since discharges are continual for a number of years a build up of radionuclides and heavy metals occurs in edible tissues of domestic animals. In the Church Rock area, the local Navajo population consumes a high percentage of locally grown meat that is continually exposed to mine discharges. It should be pointed out that 40 CFR 190 fails to regulate radon daughters such as Pb-210 and Po-210, 10 CFR 20 exempts mine effluents and NPDES permits only control release of Ra-226 and natural uranium. The Church Rock experience demonstrated that Pb-210 and Po-210 were the main nuclide of concern with respect to dose to man.

EPA is not justified in proposing less significiant standards for remote site since prediction of population growth patterns is highly predictive and uncertain. However, it should be stressed that proper citing is perhaps the most important consideration for long term controls of uranium tailings to be successful.

STATEMENT
EPA CLEAN AIR ACT

PROPOSED STANDARDS

40 CFR 61

RADIONUCLIDES IN AIR

DENVER, COLORADO

JUNE 14, 1983

BY

GERALD W. STEWART

HEALTH AND ENVIRONMENT DEPARTMENT

STATE OF NEW MEXICO

ATTACHMENT A

I am Jerry Stewart and I am Chief of the State of New Mexico's Uranium Licensing Section. I appreciate this opportunity to provide verbal comments concerning EPA's Proposed Standards for Radionuclides in Air Under the Clean Air Act. New Mexico supports the establishment of reasonable government standards that are practicable, protect the public health, safety and environment, justified, enforceable, technically feasible and cost effective for the control of radiation. I will comment on the radon limit proposed for underground uranium mines and the proposed 10 mrem/yr limit for radioactive material licenses.

EPA proposes that the annual average Radon-222 concentrations in air due to emissions from an underground uranium mine be limited to 0.2 pCi/l above background in any unrestricted area. An unrestricted area is defined as any area not under the control of the mine owner or a governmental agency.

New Mexico has conducted extensive radon monitoring around uranium milling operations with and without extensive uranium mining operations in the local vicinity. Uranium mine vents as presently operated are considered to be a large source of radon emissions to the atmosphere in the localized mining areas. In this regard, there is general agreement that a practical standard to regulate radioactive emissions from underground mines should be considered. We consider the proposed limit of 0.2 pC/l above background to any unrestricted area to be too low and unnecessarily restrictive. Our data for an extensive uranium mining district in New Mexico indicates that background can range, based on annual averages, from .4 to .5 pCi/l. One standard deviation about these averages can range from .3 to .7pCi/l. The proposed standard is lost within the data variations. Radon is very susceptible to daily cycles, seasonal cycles and weather resulting in order of magnitude variations in measurements within a single day. Interpreting radon data must be done very systematically and continuously. Establishing background for existing operations which have been underway for many years is nearly impossible. Current field instrumentation cannot determine radon measurements consistently and accurately enough to adequately establish compliance with such a standard. Thus, compliance and enforcement action would be very difficult to support at the proposed standard of radon concentration. A regulatory standard to be credible must be based on health effects and practical techniques capable of demonstrating compliance. We are unaware of any body of scientific data demonstrating that public health has been impaired at radon levels of 3 pCi/l and occupational exposures at radon levels of 30 pCi/l. Additionally, meeting this proposed standard through control of the land surfaces around mines and mine vents can be extremely difficult to almost impossible to implement in our State, due to legal rights of surface ownership, subsurface mineral estates, leasing practices, easements and rights of way. We would further suggest that EPA give consideration to a working level standard in conjunction with the radon standard, particularly for inside buildings. This would minimize difficulties encountered in determining equilibrium values for radon and its daughters. Radon decay products pose the health hazard from radon emissions.

EPA proposes that radioactive material license emissions be restricted to 10 mrem/yr to any organ of any individual and for DOE facilities, emissions be restricted to 10 mrem/yr for whole body and 30 mrem/yr to any organ of any individual.

We do not believe these standards to be reasonable, practicable or enforceable. The 10 mrem/yr is about 1.1 micro R per hour and is very close to the limit of TLD LiF detection chips. Current field instrumentation in our area will indicate a range of 5-25 μr/hr and normally does this quite rapidly with excursions above 100 μr/hr during field surveys. Other normal field sampling instrumentation havethe same limitations at these low levels and most are totally useless. Thus, useful data to demonstrate compliance would not be available and we are facing a situation where a standard is being proposed that cannot be measured or verified. Demonstrating compliance, or more importantly, non-compliance with computer modeling is an extremely questionable technique. Attempting to support an enforcement action for a violation in a hearing or court procedure would be impossible unless the violation is so gross that the licensee agrees. In that case, the hearing or court action is not necessary anyway.

It should be noted that (1) 10 CFR 20 provides a general individual limit of 500 mrem/yr (170 mrem/yr limit for the general population); (2) 40 CFR 190 limits nuclear fuel cycle facilities to 25 mrem/yr to the whole body or any organ and 75 mrem/yr to the thyroid; (3) and now new proposed 10 mrem/yr limits.

We believe it is essential that regulatory standards for radiation be credible and based on scientific data. What data has demonstrated that the ICRP and 10 CFR 20 limits have failed to protect public health and occupational safety of workers? The backup documentation must conclusively demonstrate the need for the reduced standards based on protection of public health, safety and environmental protection.

Are we really serious that a limit of 10 mrem/yr above background is required for the general population? Is there a real effect identifiable from radiation exposure greater than 10 mrem/yr above background that requires such a restrictive limit? What background value is to be used? Background Radiation varies widely around the world and the U.S. If such a restrictive limit is not based on documented scientific data, it will not be credible and not serve a useful purpose.

This concludes my comments.

STATEMENT

EPA ACTIVE URANIUM TAILINGS

PROPOSED STANDARDS

40 CFR 192

DENVER, COLORADO

JUNE 15 - 16, 1983

BY

GERALD W. STEWART

HEALTH AND ENVIRONMENT DEPARTMENT

STATE OF NEW MEXICO

ATTACHMENT B

I am Jerry Stewart and I am Chief of the State of New Mexico's Uranium Licensing Section. I appreciate this opportunity to provide verbal comments concerning EPA's proposed 40 CFR 192 "Environmental Standards for Uranium and Thorium Mill Tailings at Licensed Commercial Processing sites." On many controversial issues, EPA HAS TAKEN A POSITIVE APPROACH IN PROPOSING STANDARDS WHICH ARE BOTH PRACTICABLE AND PROTECTIVE OF PUBLIC HEALTH AND SAFETY AND ENVIRONMENTAL PROTECTION. I wish to comment briefly on four areas.

The standard of 5 pCi/gm of Ra-226 in the first 15 cm of soil does not appear to be justified in the DEIS based on health protection standards but based arbitrarily on a number above background. We believe that this standard should be reviewed and substantiated by potential health effects that can be identified at some level of Ra-226 concentration in the soil and also be comparable to the 20 pC/m^2/sec standard for the tailings pile.

We are unable to determine from paragraph 192.32(b) "Standards" whether the 20 pC/m^2/sec is only a design standard or both a design and performance standard (See footnotes 6 and 7). This should be clarified. We strongly encourage the use of performance standards to evaluate the final remedial action, preferably existing health standards of 10 CFR 20. The radon release rate is highly variable and difficult to measure and is not directly comparable to health standards. A performance standard is the only method to evaluate the effectiveness of the remedial action, assure public health and safety and release the contractor.

New Mexico has adopted and enforced ground water regulatory standards since 1977. Assuming that ground water has to meet drinking water standards is unwarranted and unnecessarily restrictive. Drinking water standards are only applicable at the point of withdrawal and use. The State of New Mexico reserves the right to set its own ground water standards.

We consider the confidence placed in artificial liners for tailings material to be totally without basis and unwarranted. Even lightly loaded artificial liners used for evaporation ponds have leaked and we can see no reason to believe that when artificial liners are loaded with 30 million tons of tailings 100 feet high, they will retain their integrity. It is our opinion that careful site selection and natural clay liners is the best combination to ensure seepage/leakage is held to an absolute minimum. Therefore, it is mandatory that flexibility in these standards be available for liners with natural material.

This concludes my comments.

NEW MEXICANS FOR JOBS & ENERGY
236 Montezuma, Santa Fe, New Mexico 87501 (505) 982-5392

June 29, 1983

The Honorable William Ruckelshaus
Administrator
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Re: Proposed Standards for Uranium Mill Tailings, 48 Fed. Reg. 19584

Dear Mr. Ruckelshaus:

These comments involve EPA's proposed standards for active uranium mill sites, published at 48 Fed. Reg. 19584 (April 29, 1983). They are submitted on behalf of New Mexico Citizens for Jobs and Energy, a non-profit public interest organization representing the citizens of the State of New Mexico.

Uranium has traditionally been a very important industry for New Mexico. In the more halcyon days of nuclear power, thousands of persons were employed in the State's industry and there were five active mills. There are now only two active mills--Homestake and Kerr-McGee. These two mills are operating far below capacity. Many mines are shut down. There is little or no new development or exploration. Thousands of uranium mining and milling employees are out of work. Local communities have been adversely affected. This sorry situation is the result of cancellations and delays in completion and operation of reactors, rapidly increasing imports of uranium from foreign supplies, and escalating costs for domestic uranium production due to stiffening regulatory demands. Much of the regulatory flux triggering the increased costs is spawned by a misplaced and largely irrational fear of nuclear reactors, uranium mills and mines, and low level radiation. This hysteria is propagated by anti-nuclear groups and by some in the media. Tighter regulations do not assuage these fears; they only encourage them. This in turn leads to yet more arbitrary and unrestrained requirements applied to nuclear energy activities. This unfairly prejudices the marketplace against the nuclear fuel cycle, including our domestic uranium industry. This in turn results in undue reliance on more risky or less desirable forms of energy. For example, conservation, which man espouse as the chief alternative to nuclear power, is expected to result in far more exposure to radiation (due to natural indoor radon) than is projected nuclear power. In order to check these tendencies, it is especially important in the nuclear area that EPA base its regulations on supportable risk assessments, a comparative risk analysis, and a balancing of costs versus benefits.

EPA proposes to require that radon emanation from tailings piles to be limited to 20 pCi/m2-sec; that tailings be stabilized for 1,000 years if achievable and in any event for a minimum of 200 years, that any groundwater be protected against essentially any degradation, and that new tailings piles or extensions be lined.

20 pCi/m2-sec radon flux would require the addition of about 10 feet of soil given New Mexico's climate. This would be costly, not simply in terms of construction expense but also in terms of environmental degradation due to heavy traffic and borrow pits. These costs are not justified given the very limited and speculative nature of the possible risk posed by radon from tailings. In particular, tailings radon cannot be detected more than a half mile downwind of a pile. EPA posits someone living atop a pile and being exposed, but federal law provides for government ownership and control, rendering EPA's assumption unrealistic and incorrect.

There are no laboratory tests to establish that earthen structures will survive erosion for many centuries. Regulatory requirements should not be imposed for which no tests or models are available objectively to ascertain compliance. If EPA specifies a longevity rule, the agency should indicate in a preamble some suggestions on how compliance may be reasonably determined. In any event, stabilization for very long periods is not cost-effective or justified.

A groundwater non-degradation standard is inflexible and not health-based. Reasonable degradation should be permitted up to health-based numerical limits at places of current or reasonably foreseeable future use.

Liner requirements make no sense if more cost-effective means are available to meet reasonable off-site standards. Requiring liners may result in a shutdown of much of what remains of our domestic uranium industry.

EPA's proposed standards diverge in many respects from the standards adopted by New Mexico's Environmental Improvement Board on the advice and consent of the Radiation Technical Advisory Council. The New Mexico standards provide for stabilization for 200 years and compliance with existing radiological protection standards in New Mexico's equivalent of 10 C.F.R. Part 20. In addition, groundwater standards issued by the New Mexico Water Quality Control Commission provide for compliance with health-based numerical limits at points of current or reasonably foreseeable future use. EPA should not adopt standards which are inconsistent with the well grounded and workable regulations which the State already has on its books.

Sincerely,

Frank McGuire

Frank McGuire
New Mexicans for Jobs and Energy

cc: Senators Domenici and Bingaman
Representatives Lujan, Skeen, and Richardson

Prepared Statement of Robert P. McNeill

Secretary, Health and Environment Department

My name is Robert McNeill. I am the Secretary for Health and Environment of the State of New Mexico. On behalf of Governor Toney Anaya and the people of New Mexico, I appreciate the opportunity to appear today and discuss some of the environmental issues of concern to New Mexico. A strong, viable federal Environmental Protection Agency is of paramount importance to New Mexico and to the nation. Many of us in the New Mexico Health and Environment Department had the privilege of working with EPA and indirectly with Mr. Ruckelshaus during his first tenure as Administrator and we were very pleased with his reappointment. But I would hasten to point out that neither Mr. Ruckelshaus and EPA nor the states can do the job mandated by the various environmental laws without a much greater commitment in budget and manpower than has been evident the past several years.

There are several areas of environmental concern which will be before the Congress this year either during budget deliberations or reauthorization debates. Because our agency has administrative and regulatory responsibilities in most if not all of these areas, I want to comment on several programs of mutual concern.

RADIATION PROTECTION

The State of New Mexico will formally comment on EPA's proposed regulations for active uranium mills and uranium mine emissions.

To briefly summarize our state's position, we believe there are several areas in which EPA's proposed regulations must be strengthened.

Because of threats posed to public health, uranium mill tailings must be isolated from mankind and the environment for thousands of years, and the standards must reflect this requirement. The proposed EPA standards are inadequate in this respect.

EPA needs to address regional impacts from multiple sources as is the case in Ambrosia Lake, NM and not just impacts from single sources. The computer modeling approach now used would allow radon from multiple sources to exceed the regulatory limit.

We support the EPA proposal to regulate uranium mine radon emissions as this is the largest source of radon associated with uranium mining and milling in New Mexico. However, EPA should strongly consider placing more emphasis on measured values rather than modeled ones to determine compliance.

Finally, the proposed EPA regulations do not adequately ~~failed to~~ recognize the long-term hazards and relative importance of continual discharge of mine waters to surface drainage. Such discharges in New Mexico have resulted in potential long-term contamination of domestic animals and man's food chain.

Radon in Housing

I would like to say a word about a most important radiation insult. During our study of radon in the uranium production areas we have become aware that it is really radon daughters that injure people. A case in point is past uranium mining practices. Senator Domenici held hearings in Grants several years ago which dramatically demonstrated the injury caused by radon daughters to uranium miners in the late 1940's and early 1950's. The Environmental Improvement Division has acquired instrumentation to determine radon daugher concentration in homes. We were shocked to find that radon daughters concentration in homes not even remotely connected with the uranium industry could reach alarming values. This is due in part to the soil under the home and is exacerbated by attempts to seal the home against heat loss. The EPA estimates that between 6,700 and 13,400 cases of lung cancer per year are attributable to radon daughters. We plan to enlarge our program in the hope of learning how to minimize this threat to New Mexicans. We would appreciate EPA's attention to this problem which may be one of the most important radiation problems we have today.

CLEAN AIR ISSUES

New Mexico supports the 1977 Amendments to the Clean Air Act as representing an increased national commitment to cleaner, healthier air. Strong federal legislation has provided the necessary legal framework supporting New Mexico's very successful regulatory efforts over the past decade. This success has been rather strikingly reviewed in a recent study of statewide air pollutant emissions. Citizen groups, our State government and

New Mexico industry can point to the fact that total emissions of sulfur oxides and particulate matter are now controlled to the level of the 1940's. Accordingly, we are confident that energy and economic development can continue without compromising efforts to attain and maintain air quality standards designed to protect health.

The Department has in the past expressed its disappointment to the Environmental Protection Agency that the effective federal/state air pollution control partnership envisioned by Congress failed to materialize. Although the placement of enforceable deadlines in the Clean Air Act for EPA action on regulations matters may remedy this situation, it does appear that responsible administration of the Act is the key to developing an effective partnership. The department has witnessed improvements in EPA review times, in EPA's support for technical training and the Agency's provision of expert witnesses at state public hearings. EPA has also shown evidence of a newly active role in its support for New Mexico's concern for controlling emissions of lead from the ASARCO smelter in El Paso, Texas. Acceptable lead levels must be restored to the Anapra/Sunland Park area where seriously high measured levels of lead have been determined. New Mexico urges EPA to continue to strengthen efforts to bring this smelter under control in terms of air contamination.

It is important that EPA recognize certain New Mexico air quality problems which could receive more expeditious relief with strong EPA research support:

1. Present emissions of nitrogen oxides represent levels ten times those of the 1960s. Control alternatives may not be reasonably available for large stationary sources. The Department is now

engaged in a research effort to define the atmospheric behavior of (NO_x) nitrogen oxides and its effect on the very protective (NO_2) nitrogen dioxide state standard for which there is no federal equivalent. Financial assistance from EPA was essential to commence this research project. Further support may be needed to define control alternatives necessary for sources to comply.

2. Visibility is an environmental resource of unique value to New Mexico and other western states. Western states have pooled their limited resources this year to study policy and technical alternatives available to them to protect visibility. More assistance may be necessary in the future.

3. The entire problem of long-range transport of air pollutants is a very vexing one as it relates to acid rain and visibility protection. Atmospheric modeling techniques need to be developed further through research efforts of EPA and the states.

The Administrator should be commended for his withdrawal of the EPA economic sanctions policy as proposed on February 3, 1983. Mr. Ruckelshaus, your policy, tracks well with the state's position on EPA's previously unreasonable interpretation of the Clean Air Act. The previous policy would clearly maximize economic disruption to areas of the state which have shown good faith efforts toward compliance with the federal law.

To further ensure New Mexico's compliance with the Clean Air Act, the Department urges your Agency's prompt promulgation of its non-ferrous smelter order rules and inahalable particulate standard. These long overdue rules may serve to further delay state's air quality improvements. These are truly "moving targets" causing unreasonable regulatory uncertainty and they clearly go against the intent of Congress.

The Department supports the vehicle emissions testing program now in place in Bernalillo County. With carbon monoxide being a potentially more serious health problem at high altitudes, we hope that this program will reduce this pollutant to healthful levels by the federal deadline of 1987. However, the pressure of a mandatory rule such as this one accompanied by the threat of sanctions should be part of a balanced national approach which would provide continued stringent rules for the automobile manufacturers themselves. The attainment possibilities are questionable enough with the present (CO) carbon monoxide tailpipe standards.

Tomorrow, the New Mexico Environmental Improvement Board will be holding a public hearing to consider the adoption of a New Mexico Prevention of Significant Deterioration regulation. With its adoption, the State would soon be on its own in the PSD arena. As you know, the State has long supported the concept of PSD as essential for protection of the very unique characteristics of Western air quality. We are anxious to complete the turnover of this program to New Mexico from EPA.

CLEAN WATER ISSUES

Another area of environmental concern which merits discussion is that of water quality. I would like to encourage both Congress and the EPA to recognize the need for continued federal funding for construction of municipal sewage treatment plants at least at the present level through 1988. Realistically, the need for federal support in New Mexico will extend for several years beyond that.

The fact is that in most of the western states municipal sewage is the major point source of waste load on receiving streams. Given the importance of water in the west, and the inability of most municipalities and state governments to provide total financing of treatment plants, the need for continued federal support is obvious.

Another issue of major concern to the Department is the recent federal direction in addressing ground water protection. Certainly many states have been remiss in protecting this valuable resource from pollution. There is also no question that if states cannot or will not develop measures to protect ground water, then the federal government must. There is a serious question as to whether the present approach of attempting to regulate by design standards is the best.

For example, New Mexico implemented standards and regulations to protect ground water in the spring of 1977, one of the first states to do so. Those regulations have considerable testing in the courts, and with minor exceptions have been upheld by our state supreme court. Over 230 sources have been permitted under those regulations without demonstrable failure.

Our regulations differ from EPA's in that they specify performance criteria rather than design criteria. In order to meet the requirements for primacy delegation of the Underground Injection Control Program authorized under the Safe Drinking Water Act, we had to adopt an extensive set of new regulations. The result is we approximately doubled the existing body of regulation to cover less than 2% of our sources, and in our opinion without any significant improvement in the level of protection.

Even though this seems a classic example of disproportionate allocation of scarce regulatory resources, the state has strived to cooperate with EPA to implement the Congressional mandates regarding ground water protection, and the EPA has demonstrated some flexibility in accommodating the state's point of view. Unfortunately, even this small amount of flexibility is missing from EPA's interpretation of the new Hazardous Waste Land Disposal Regulations under the Resource Conservation and Recovery Act. For the state to administer these regulations we are told word for word adoption of the federal regulations is the only acceptable approach. In my opinion, this is not the best way to achieve workable, effective regulation. I do appreciate the need for some degree of uniformity in regulation nationally, but would suggest that such uniformity can be accomplished as effectively in looking at performance rather than specifying design.

It is interesting to note that the protection of ground water seems the vehicle for better integrating several of the major environmental programs which have been operating as though they were independent and unrelated for too long. The effort toward integration is commendable.

The issue of toxic wastes should operate to force a degree of integration. There is a crying need in the area of toxic and hazardous waste for additional research which would give both EPA and state programs the necessary basis for establishing numeric criteria. From an enforcement viewpoint, numeric standards are much easier to enforce than either narrative or generic standards. Unfortunately, the data base for which to establish such standards is pathetically weak. Basic research in this area is critical and must be supported to a greater extent than it has been to date.

SUPERFUND

~~With regard to~~ The Federal Comprehensive Environmental Response, Compensation and Liability Act of 1980, known as Superfund, ~~which~~ was enacted by Congress to provide for the cleanup of inactive hazardous waste disposal sites and to establish liability, compensation, cleanup and emergency response for hazardous substances released to the environment.

As provided in Section (8)(B) of this Act, the Environmental Protection Agency (EPA) published in October, 1981 an Interim list of 115 top priority response target sites which was subsequently expanded to 160 sites in July, 1982 and to 419 sites in December, 1982. Four of the 418 sites are located in New Mexico. They include: Albuquerque South Valley, Homestake Mining Company (Milan, N.M.), Atchison, Topeka and Santa Fe Railroad (Clovis, N.M.), and United Nuclear Corporation (Church Rock, N.M.).

I am aware that EPA has increasingly come under public criticism for what is perceived as a failure to implement this Act in an expeditious manner. This criticism appears to be largely due to public expectations for timely remedial actions on priority sites not being met.

I also share this concern for timely remedial actions regarding the listed sites in New Mexico. For example, during September, 1981, Remedial Response Fact Sheets for the Albuquerque South Valley and the Homestake Mining Company sites were submitted to EPA Headquarters by EPA Region VI for funding consideration to initiate the remedial investigations. To date, the remedial investigations at these two sites have not been initiated. Similarly, EPA negotiations regarding remedial investigations at the United Nuclear Corporation site and the Atchison, Topeka and Santa Fe Railroad site have been underway since at least February, 1982 and July, 1982 respectively, with no resolution to date. Thus lengthy delays in the implementation of remedial investigations at the 4 New Mexico sites greatly concern me.

Additionally, it is my understanding that a request was made to EPA Headquarters by EPA Region VI during September, 1982 to set aside $350,000.00 to fund the investigation and feasibility studies at the Albuquerque South Valley site. Pursuant to Section 104 (c)(3) of the Act, the State will be required to provide 10% of the cost of investigation and feasibility at the site which translates into $35,000.00 based on the September, 1982 funding request. However, the New Mexico Environmental Improvement Division of the Health and Environment Department informs me that EPA's present cost projection for the Albuquerque South Valley site is approximately $847,000.00. Such an escalation in the resulting 10% cost to the State disturbes me, particularly in these austere economic times. How are states expected to appropriate the necessary funding when these costs become moving targets?

Finally, regarding the United Nuclear Corporation site, EPA Region VI is finalizing an Administrative Order to be sent to the Corporation. As I understand, this Order would set up a time schedule for an investigation and the development of a plan to clean up the site. However, indications are that EPA Region VI is not certain, even after months of expended efforts involving the technical and administrative assistance of the State, that EPA Headquarters will allow this Administrative Order to be filed. On this point, I suggest a policy be developed giving the EPA Regional Office greater discretion in dealing with individual states and making site - specific decisions. Often, such enforcement documents, draft contracts, reports, and agreements or decisions mutually approved by the State and the EPA Regional Office are rejected or unacceptably altered by EPA Headquarters. This causes inordinate delay in program implementation and a concomitant increase in costs. Many of these delays are the result of EPA Headquarters' staff's unfamiliarity and lack of involvement with individual sites. These difficulties are often trivial and could be avoided by some degree of decentralization in the Superfund implementation program.

In conclusion, I want to thank Senator Domenici for conducting this hearing in Albuquerque today, and Administrator Ruckelshaus for joining Senator Domenici. I recently had the opportunity, along with a number of State environmental officials, of meeting with Mr. Ruckelshaus in Washington. That meeting was reassuring. I recall one comment the Administrator made concerning the need for a stronger scientific base for policy decisions in environmental matters, and I was pleased to hear that Mr. Ruckelshaus recently addressed the National Academy of Sciences on that point. As a state official, I can confirm that we share a concern that policy making in this area be as scientifically sound as possible. Thank you very much.

STATE OF NEW MEXICO
GOVERNOR'S CABINET
SANTA FE
87503

TONEY ANAYA
GOVERNOR

ROBERT McNEILL
SECRETARY
FOR HEALTH & ENVIRONMENT

July 25, 1983

The Honorable Pete Domenici
4239 Dirksen Senate Office Bldg.
Washington, D.C. 20510

Attention: Linda Findley

Dear Senator Domenici:

In response to your request at the July 6, 1983 public hearing of the Senate Environment and Public Works Committee in Albuquerque, the Health and Environment Department has compiled a list of states which have either accepted full or partial delegation of the Prevention of Significant Deterioration program from the U.S. Environmental Protection Agency. This information was obtained from EPA's Research Triangle Park.

The enclosed introductory statement of the Environmental Improvement Division, which presented the proposed state PSD regulation to the Environmental Improvement Board at their recent public hearing, should give the Committee further background concerning the reasons for the Department's decision to pursue full delegation at this time. Over the past few years, the Department decided to avoid a lengthy regulatory process for two major reasons. First, the Department felt that it would be advantageous to gain experience with the PSD process under a partial delegation, so that the Department would be better prepared to propose its own regulation and to implement the program. Second, the major PSD questions have now been settled by the courts. The Department decided not to propose the state PSD regulation last fall, as originally planned, due to the intense Congressional debate on major PSD provisions which may have changed the PSD program significantly.

Prior to the recent amendments to the New Mexico Air Quailty Control Act, the Board's PSD regulation was to be "no more stringent than required by the federal act and federal regulations". As amended this year, the Board's PSD authority is now tied to the stringency of the federal law and regulations "as they existed on January 1, 1983". Thus, the PSD regulation which the Board will adopt later this summer, is not now subject to change as frequently as it would have been under the Act's previous language.

The Department is pleased to provide you with this information. Should the Committee require additional information, please contact me or Tom Udall, Acting Director of the Environmental Improvement Division.

Sincerely,

Robert McNeill
Secretary

RM/tu

Attachment

PSD STATUS OF STATES

SIP REVISIONS	FULL DELEGATION	PARTIAL DELEGATION	NONE
Region I			
Maine-Jan., 1980 Vermont - 1980	Massachusetts-June '82	New Hampshire-Sept., 1982 Connecticut -Sept., 1982 Rhode Is. - Sept., 1982	
Region II			
	New York - July, 1982 New Jersey- April, 1983		Puerto Rico Virgin Islands
Region III			
Delaware-Mar., 1982 Maryland-Feb., 1982 Virginia-June, 1981	Philadelphia, Penn. - July, '83	*Alleghany Co. Penn. *Pennsylvania West Virginia *Full Delegation expected by Oct. 1, 1983. Washington, D. C. - SIP Revision by Oct. 1, 1983	
Region IV			
Nth. Carolina-Feb., 1982 Sth. Carolina-Feb., 1982 Alabama-Nov., 1981 Georgia-Feb., 1982	Mississippi-June, 1981 Tennessee-June, 1981 Nashville, Tenn-Nov.1982 Kentucky-May, 1980	Florida-Oct., 1980 (SIP revision promulgated)	
Region V			
	Illinois-April, 1980 Indiana-Jan., 1982 Michigan-Sept., 1979 Minnesota-Jan., 1978 Ohio - May, 1980	Wisconsin-Aug., 1980	

SIP REVISIONS	FULL DELEGATION	PARTIAL DELEGATION	NONE
Region VI Oklahoma-SIP revision promulgated Arkansas-Feb., 1982		Louisiana-Sept., 1981 Texas - April, 1981 New Mexico - Feb., 1982	
Region VII Missouri-June, 1982		Nebraska-SIP revision promulgated	Iowa Kansas-SIP revision promulgated
Region VIII Montana-July, 1982 Nth. Dakota 1979 Wyoming-Sept., 1979 Utah - Feb., 1982			Colorado South Dakota
Region IX Arizona-May, 1983 Clark Co., Nov.-Feb., 1982	Nevada-May, 1983		California Hawaii
Region X Oregon-Aug., 1982 Alaska-July, 1983		Washington-SIP revision promulgated	Idaho-SIP revision promulgated

Statement Concerning Proposed
Air Quality Control Regulation 707,
Prevention of Significant Deterioration

Lee D. Lockie, Chief
Air Quality Bureau
Environmental Improvement Division
Health and Environment Department

July 7, 1983

1. Introduction

Mr. Chairman, Members of the Environmental Improvement Board: my purpose in appearing before you today is to provide the Board with a brief statement in the way of background information on the Environmental Improvement Division's proposed air quality control regulation and accompanying State Implementation Plan revision. This lengthy regulation, which is found in Exhibit 4, sets forth procedures through which the Division would administer the federal Prevention of Significant Deterioration or "PSD", program. "PSD" is an air quality permitting program which governs major new sources, and modifications to major sources. The PSD program is designed to see that a national air quality goal is achieved in practice, that is the goal of minimizing deterioration of air quality in areas of the nation where the air is cleaner than the levels set by the National Ambient Air Quality Standards (NAAQS). Thus, with New Mexico's small number of nonattaining areas, the PSD program governs major source permitting for air quality on well-over 99 percent of the land area within the State of New Mexico.

On February 16, 1982, the regional office of the Environmental Protection Agency (EPA) in Dallas, Texas delegated administrative and technical review responsibilities for PSD to the Division. Under the terms of this partial delegation of EPA's PSD program, the Division administers the program under the current federal PSD rules found at Title 40 Code of Federal Regulations (CFR) 52.21 (Exhibit 6). Under the delegation agreement, the Division conducts pre-application meetings and technical reviews of PSD permit applications, inspects sources subject to EPA's PSD rules to determine compliance, reviews compliance test reports, and acts in instances of noncompliance with PSD rules for all of these sources in New Mexico. Once the Division makes a decision to issue a PSD permit, a so-called Final Determination (which includes the application and the technical analysis) is sent to the EPA; under a dual signature agreement, EPA must then take action on the permit within ten working days of receipt. This partial delegation has worked fairly well. The Division has endeavored to keep EPA informed at various stages in the review process to resolve issues of interpretation well-ahead of final action. EPA in turn has provided training and a well-informed staff to aid the Division in preparing to operate it's own program. The Division now has adequate resources and knowledge of the PSD program to implement a full state program based on the federal regulations found at Title 40 Code of Federal Regulations Part 51.24. (Exhibit 7)

With the adoption of the proposed regulation, and EPA approval of the entire SIP revision, the Board would allow the Division and the Board to assume full authority for the PSD program. The 1977 Amendments to the Clean Air Act require that all states adopt their own PSD plans.

You may wonder why it has taken the Division nearly six years, following the incorporation of PSD into the federal Act, to arrive at a proposed regulation. The Division has taken the position in the past to wait for the dust to settle for a few moments on the PSD rules prior to proposing a regulation for adoption by the Board. The recent action by the State Legislature to tie the Board's regulation to the January 1, 1983 federal rules and Act, the final settlement of major PSD questions by the courts and the slowdown of Congressional debate on the Clean Air Act are the main reasons for proceeding as the Division is now. In addition, assuming full authority at this time does have a number of advantages:

1. First, the Division feels that the program is best administered at the state level to be more responsive to state concerns for air quality

protection and economic development. This advantage will hopefully become more evident during the course of the Division's further testimony at this hearing.

2. Second, the necessity for duplicate federal reviews will be eliminated; EPA would review the state's program for adequacy during annual evaluations where audits for permits are conducted by the Agency.

As part of the Board's deliberations on this matter, it is important that the Division draws your attention to State and Federal law which noticeably limit the discretion of the Board in its decision making as to the provisions of the state's PSD regulation. First, federal rules found at 40 CFR 51.23 provide that the PSD definitions in the state plan be "at least as stringent as" or "more stringent" than the federal rules. This is consistent with similar requirements of the federal Clean Air Act Section 116 which provides that no state shall adopt rules less stringent than federal New Source Performance Standards (NSPS) or National Emission Standards for Hazardous Air Pollutants (NESHAP). Second, the newly amended New Mexico Air Quality Control Act (Exhibit 1) provides, under "Duties and Powers of the Board", Section 74-2-5 (B)(1), that the Board may adopt regulations to prevent significant deterioration of air quality, "provided that such regulations shall be no more stringent than but at least as stringent as required by the federal act and federal regulations as they existed on January 1, 1983 pertaining to .... prevention of significant deterioration." This section of the state law also provides that the PSD regulation adopted by the Board "be applicable only to sources subject to such regulation pursuant to the federal act." Similar language in the state air quality law applies to other federal programs not under consideration by the Board today such as visibility protection, permitting in nonattainment areas, and federal standards of performance. Similar language is repeated further on in the law in Section 74-2-7, entitled "Permits" where the Board is also directed by the New Mexico Legislature to be "no more stringent than but at least as stringent as" federal PSD rules as they existed on January 1, 1983. As you may know, the New Mexico Legislature amended the New Mexico Air Quality Control Act during the past session to avoid tying the Board to the ever-changing federal rules by inserting language indicating an acceptance of the currently stringent 1983 federal rules.

II. Brief History of PSD

The federal Clean Air Act has a statement of findings and purposes on the first page of the Act. One of the purposes of the Act is stated by Congress in the following language from the Act in Section 101 (b)(1): "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." A Sierra Club lawsuit, in which the State of New Mexico joined as friend of the court, on the meaning of this stated Congressional purpose, led to a court ruling that EPA must promulgate regulations to prevent degradation of good air quality. Incidentally, some 35 states joined New Mexico with briefs supporting the PSD position of the Sierra Club. EPA regulations which were promulgated in 1974 were challenged and remained in question until Congress established a detailed PSD program in the 1977 Amendments to the Clean Air Act.

III. 1977 Amendments to the Federal Clean Air Act

With the passage of the 1977 Amendments to the Federal Clean Air Act, Congress recognized the importance of protecting air quality in areas cleaner than the National Ambient Air Quality Standards. Congress set forth two goals and programs reflective of a growing national concern for air quality: prevention of significant deterioration (PSD) and protection of visibility. These programs are designed to minimize increases in pollutant levels, from major new and modified sources, through the application of best available control technology (BACT) on a case-by-case basis and through pollutant ceilings imposed by an air quailty increment system.

In their examination of the legislative history of these Amendments, the National Commission on Air Quality concluded that the Congress made these important findings which serve as the intent of the PSD program:

1. All known or suspected health effects of air pollutants may not be sufficiently protected by the *primary* National Ambient Air Quality Standards (NAAQS).
2. Long-range visibility, recognized by Congress as a very valuable, fragile natural resource particularly in the West, was deteriorating and could also not be protected by the *secondary* National Ambient Air Quality Standards.
3. Air pollution control requirements should be the same in cleaner air areas as in the industrialized areas so as to eliminate unfair competition among states for new growth.

Just as a review, the primary NAAQS are designed to protect public health, with an adequate margin of safety. The intent of the secondary NAAQS is to protect public welfare. The PSD program operates in areas where the air is *cleaner* than these minimum standards and provides additional protection such that the air quality does not deteriorate significantly. The PSD program is unique in the protection it provides for national parks and wilderness areas due to their intrinsic beauty.

The extent of the visibility protection program is actually much broader, as provided for in the law, than its provisions in the PSD program. The regulation we will be discussing today provides for consideration of visibility protection needs for new sources only. The 1977 Amendments provided for a broader separate program to cover visibility impairment from major existing sources.

The 1977 Amendments expanded the PSD program of EPA's 1974 regulations in several important areas.

1. PSD areas had to be specifically identified by the states. You may remember that this was done in New Mexico during the adoption of the 1979 State Implementation Plan for "nonattainment areas". Basically, all those areas that were not "nonattainment", were classified as "PSD" areas.
2. Congress permanently designated the larger national parks and wilderness areas as deserving of strict air quality protection as pristine areas. These areas are known as Mandatory Class I areas and may not be redesignated.
3. The number of sources covered by the program was increased by the new law.
4. The concept of Best Available Control Technology (BACT) was expanded by Congress with the specific intent of having control technology decisions made by the States on a case-by-case basis. The Act required sources subject PSD to apply BACT for each federally-regulated pollutant. To quote from the Act, BACT is

"an emissions limitation based on the maximum degree of reduction .... which the permitting authority, on a case-by-case basis, taking into account energy, environmental and other costs, determines is achieveable...."

The concept of BACT is critical to the PSD review in that it allows States to control to the level of protection needed by that state.

5. The number of pollutants to be regulated under PSD was also expanded by the 1977 Amendments. That is, the PSD program could now assign pollutant ceilings or increments for carbon monoxide and nitrogen dioxide, in addition to the established increments for sulfur dioxide and total suspended particulate matter.

IV. Latest Federal Rules

After passage of the new federal Act of 1977, EPA promulgated two sets of new PSD regulations on June 19, 1978. One set specified the minimum requirements that a state implementation plan would have to meet with respect to PSD. This was codified at 40 CFR 51.24. (Exhibit 7)' The other set changed the 1974 PSD requlations to conform to the new and expanded Congressional PSD requirements and were codified at 40 CFR 52.21. (Exhibit 6) Ensuring court challenges culminated in a District of Columbia Circuit Court opinion in the case of Alabama Power v. Costle. The decision upheld some provisions of the 1978 PSD regulations and overturned others. Responding to the Alabama Power decision, EPA again promulgated new sets of PSD regulations on August 7, 1980.

Since that time the federal PSD regulations have not changed but a settlement is expected in the future on a challenge to the regulations by the Chemical Manufacturers' Association. We do not know at this time how the federal regulations may change. The Department's position is this: We are anxious to adopt the PSD program and implement it ourselves. Six years have elapsed since the Clean Air Act Amendments of 1977 required the states to adopt measures to prevent significant deterioration of air quality. During that time a major court decision ruled on most of the primary sections of the PSD regulations. The Department is satisfied with the PSD regulations as they exist today and wishes to adopt them without further delay.

Exhibit 6 is a copy of 40 CFR 52.21, the current federal PSD Regulations. Exhibit 7 is a copy of 40 CRF 51.24, the Plan Requirements for State Implementation Plans. It is important to distinguish these two In developing Regulation 702, the Department has followed and met the plan requirements of 40 CFR 51.24. At times we referred to the federal regulations themselves in 40 CFR 52.21 for possible clarification. Also, we have worked closely with EPA in developing the proposed implementation plan. Several draft copies of the revision have been reviewed by EPA, and their comments have been taken into consideration.

In preparing proposed Regulation 707 the Department has tried to make the regulation clearer and more concise than its federal counter part. Where possible, we have modified language to make it more understandable. We have taken the liberty of completely deleting all sentences of greater than 850 words in length. However, we wish to make it clear that in our opinion Regulation 707 contains the same requirements as the federal PSD regulations. There is one exception to this. This occurs in Subsection I.8. of Regulation 707 which concerns visibility monitoring requirements and in Subsection I.5 which addresses the role of the Department in assessing visibility impairment in Class I areas. Also, there is language in Subsection O.1, concerning how the federal land manager and the Department will interact in evaluating PSD permit applications. These departures from the federal PSD regulations will be discussed later by Mr. Blankenship.

V. Overview of the PSD Program

overheads

I would like to, at this point, provide you with a brief overview of the PSD program. Part C of the Clean Air Act (Exhibit 5) established three land classifications which limit maximum allowable future increases in ambient concentrations of two pollutants: sulfur dioxide and total suspended particulate. To fullfill one of the major purposes of the Act, Congress designated certain federally-managed land of special national value to be Mandatory Class I areas. These areas are deserving of pristine air quality protection and may not be redesignated to a less protective air quality classification. These areas include international parks, wilderness areas greater than 5,000 acres in size, national memorial parks greater than 5,000 acres in size and national parks greater than 6,000 acres in size.

In New Mexico, the Mandatory Class I areas are: Bandelier Wilderness, Bosque del Apache Wilderness, Gila, Pecos and Salt Creek Wilderness, San Pedro Parks, Wheeler Peak and White Mountain Wilderness, and Carlsbad Caverns National Park. These areas total over 800,000 acres of land in New Mexico and are shown in the map as Exhibit 2.

The rest of the state, with the exception of nonattainment areas, is classified as Class II. This classification allows for more moderate development. There is a third class, Class III, which allows for more intensive development. A Board action at public hearing would be required to redesignate an area to Class III. This class essentially allows deterioration to the level of the NAAQS.

Each class has a set of TSP and SO_2 increments, shown in Table 4, of

Exhibit 3. These are the allowable increases. Note how these compare to the NAAQS for each pollutant. The NAAQS is a pollutant ceiling, while the increment is an allowable increase over an established baseline air quality level. EPA was to develop PSD increments for other pollutants, called SET II pollutants such as carbon monoxide, ozone and nitrogen oxides, but this has not yet occurred.

Congress established an outline for redesignating certain classes to one or another class. National monuments, national primitive areas and national wildlife refuges which exceed 10,000 acres in size which are on Class II areas, may only be redesignated to Class I ~~or Class III~~.

A PSD preconstruction review and permit is required of all new major sources or modifications to major sources. Major sources are those which emit or have the potential to emit 250 tons per year of any regulated air pollutant. A total of 28 special source categories are subject to PSD if they emit or have the potential to emit greater than 100 tons per year of any regulated pollutant.

The applicant must perform an air quality analysis to show that neither an ambient air quality standard nor a PSD increment will be exceeded as the result of the emission generated from the major new source or modification.

The applicant must also demonstrate that Best Available Control Technology (BACT) will be utilized by the proposed new source. BACT is an emission limitation determined by the Division on a case-by-case basis. To quote from the federal Act again, BACT takes into account "energy, environmental and economic and other costs."

The Act also establishes waiver variance procedures from the Class I SO_2 increments which Mr. Blankenship will discuss in detail later on in this hearing.

Visibility protection is another important element of the PSD provisions of the federal Act and rules. Congress established a national goal to prevent any future and remedy any existing impairment of visibility due to man made air pollution in Mandatory Class I areas. Just how this program functions as part of the PSD permitting process will also be discussed by Mr. Blankenship.

STATEMENT BY
ROBERT M. WHITE, PRESIDENT OF THE CITY COUNCIL
CITY OF ALBUQUERQUE

TO THE

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
HEARING ON
STATE OF THE ENVIRONMENT: A NEW MEXICO PERSPECTIVE
2:00 P.M. — WEDNESDAY, JULY 6, 1983
501 COPPER, N.W.
ALBUQUERQUE, NEW MEXICO

I appreciate the opportunity to testify today on behalf of the Albuquerque City Council and the citizens of this area. I am pleased with the changes that have recently taken place in EPA and with the apparent renewed emphasis on environmental protection which is so important to the world, this nation, and the health and environment of this state and area. Albuquerqueans and New Mexicans have a long history of insisting on effective environmental health programs to protect our environment and the health of our citizens. Our citizens have repeatedly shown through legislation and funding that our environment is our prime asset, that it must be adequately protected, that we can't have a viable economy without a quality environment, and that our environment once degraded or destroyed may never be returned to satisfactory quality. We know that effective protective measures must be continued and in some cases instigated to prevent environmental degradation, and to provide a high level of environmental health standards and regulations. We also know that we cannot, and should not, delay taking action until every final shred of evidence of damage is known. We are also aware that technology exists to adequately control pollution and that absence of such controls frequently reflects a lack of political will rather than the absence of technological capability. Certainly our citizens demand and deserve a quality environment for reasons of health, safety, comfort, and well-being.

Perhaps this area is somewhat unique in that it still has options open to determine its own environmental future for this and future generations. This area has a delicate ecological balance and environmental protection measures must, therefore, be of some preventive nature. I have no doubt that life can continue in some manner in a grossly polluted environment, but I feel that we should thrive rather than merely survive.

The Albuquerque City Council has reacted positively to funding needs and requests, and has taken reasonable action to provide for effective local environmental health programs to protect environment and our citizens, and to fill gaps where state and federal activities are not adequate to our needs and expectations.

A 1981 public opinion poll conducted in Albuquerque and Bernalillo County found that:

"Over 90 percent of the population believe that there is an air pollution problem in Bernalillo County."

"Over 70 percent believe that air pollution will get worse by 1985."

Approximatley 83 percent believe that automobiles are a main source of air pollution in Bernalillo County."

"Approximately 24 percent say that air pollution has affected their health."

"Approximately 43 percent believe that air pollution will be harmful to their health in the future."

"Over 70 percent believe that local government should try to solve the problem of air pollution caused by automobiles." "Over 70 per cent favors the MVIP (I/M)."

"Conclusion: Although the problems as well as the benefits of a Motor Vehicle Inspection Program were cited, RESPONDENTS OVERWHELMINGLY FAVORED THE MVIP (I/M) as a viable action toward improving air quality in Bernalillo County."

You are also aware, of course, that National Pollster, Lou Harris, has reported that "... not a single major segment of the public wants environmental laws made less strict. First, those most in favor of not relaxing the clean air regulations: Big city residents (83-14%), young people under 30 (90-10%), women (82-13%), professional people (83-15%), white collar workers (82-16%), union members (82-16%), Democrats (84-13%), Republicans (76-22%), Conservatives (76-21%), political moderates (83-16%), the South (79-17%), the West (80-17%), and rural areas (77-19%)."

It has been understandable and expected that a few segments of our society opposed to environmental protection activities have attempted to create a backlash and turn public opinion against this essential public health measure. It is obvious that such efforts have not been successful as indicated by results of the aforementioned public opinion polls. Costs of environmental health have been exaggerated by some of these interests. Studies have indicated that the effect of environmental protection programs on the economy and on inflation have been insignificant, while at the same time such measures have created new jobs, new industries and, in many cases, substantial new tax revenues for state and local governments.

It is regretable that the results of the 1981 elections were improperly interpreted by some as indicating there should be a roll-back in environmental health activities and programs. Obviously, this has not been the case and the American public has not been willing to stand for turning back the clock and repealing environmental protection measures.

As you are rebuilding EPA, we hope you will have appropriately trained and experienced environmental scientists who will bring credit to your agency and environmental quality to this nation. We recommend that you set a tone so that EPA policy-makers are accessible to state and local officials and work "with" state and local officials rather than "on" them. Certainly more input, coordination, and cooperation is necessary in this area.

Additionally, we are vitally concerned that there be no weakening of key federal environmental measure pertaining to air and water pollution, water supplies, solid wastes, and hazardous wastes. In the southwestern United States, we are specifically concerned that there be no weakening of the "prevention of significant deterioration" provision of the Clean Air Act.

The federal hazardous waste program was designed to address an issue of importance of all of us. However, the program was improperly designed by not considering the essential role of various agencies of local government such as police departments, fire departments, refuse departments, and environmental health departments. A serious gap remains at the local level where insufficient effort has been devoted to the essential roles of those personnel who may be first to know of hazardous waste problems, who may be first on the scene of spills, and who are the most likely to be contacted for information and results. The hazardous waste program should be redesigned to address the roles of local government and provide funding such as that currently granted to state agencies.

There also remains considerable confusion over the status of hazardous waste issues presumably being addressed under the "Superfund Program" such as that in our own South Valley area.

It is regretable that EPA noise pollution control programs have been dismantled. These programs should be reinstigated at the 1982 fiscal year funding level.

I recommend you consider that EPA design and distribute public information materials regarding the 207-A and 207-B warranty provision to the end that automobile owners whose vehicles failed to pass the inspection maintenance tests are able to quickly and effectively take advantage of warranty provisions.

Small areas of our city and county were declared "non-attainment" areas for total suspended particulates. While you have notified us that there will be no sanctions imposed, we feel that a good faith effort to solve these problems can only be pursued if EPA adopts a fine particulate standard so that we may effectively design control measures.

Funding for the federally mandated inspection maintenance program remains a problem. Requirements for a federal fuel tax for non-attainment areas would be an equitable measure to cover the costs of federally mandated inspection maintenance programs.

I understand that federal highway specifications for highway construction materials require dry screening, thereby creating a noticeable air pollution problem within that area. The possibility of wet screening for such materials in the arid southwest should be reviewed.

We know that acid deposition is no longer considered to be confined to the northeastern United States and Canada. Due to prevailing winds and locations of large smelters and power plants, there must be continuing careful surveillance and research to prevent acid deposition in the Albuquerque area rather than resorting to expensive after-the-fact treatment.

Additionally, basic research efforts have been drastically curtailed. Research is an absolute necessity if we are to stay abreast of environmental problems and design effective measures to control such problems.

We recommend that EPA place additional emphasis on recycling, waste exchange, resource recovery, and process changes to eliminate the production of hazardous waste as alternatives to attempting to dispose of such wastes in secure hazardous waste landfills.

EPA technical publications should be readily available to the public and could be distributed through state and local environmental health offices.

We have serious concern about the continuing degradation of ground water supplies in the Mid Rio Grande area and sincerely invite increased research and EPA consultation to protect the quality of our limited and precious water resources.

Confusion continues over the programmatic coverage and definition of different wastes and chemicals under the hazardous waste program, the toxic chemical program, and requirements pertaining to oil spills. Obviously, the statutes and regulations should be redesigned to include all such hazardous wastes and chemicals under one program. When PCBs are not considered subject to the hazardous waste requirements, something is amiss.

We appreciate the support and consultation which EPA has offered on many occasions in the past. Most recently, EPA has provided funds for studying the "brown cloud" phenomena in this area and I wish to take this opportunity to thank the responsible officials, including Senator Domenici,for his interest and role in gaining funds for this study. I know you will accept my comments as constructive and intended solely to provide local input for more effective environmental health measures for the citizens of Albuquerque and the Mid Rio Grande Valley of New Mexico.

New Mexico Citizens for Clean Air and Water

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
HEARING ON
STATE OF THE ENVIRONMENT: A NEW MEXICO PERSPECTIVE
1:00 P.M. -- WEDNESDAY, JULY 6, 1983
ALBUQUERQUE PUBLIC LIBRARY AUDITORIUM
501 COPPER, N.W.
ALBUQUERQUE, NEW MEXICO

My name is John Bartlit. I am State Chairman of New Mexico Citizens for Clean Air & Water, a statewide organization of some 2000 members concerned about the environment. I hold a doctorate in chemical engineering from Yale University and have been closely involved since 1969 in issues of industrial air pollution, especially pollution from New Mexico's two largest sources -- copper smelters and coal-fired power plants. I was a member of the Environmental Advisory Committee to the Federal Energy Administration, also Environmental Vice-Chairman of the Air Pollution Task Force of the National Coal Policy Project -- a joint industrial-environmentalist effort under the Georgetown University Center for Strategic and International Studies.

I. GAPS IN STRATEGIES FOR MAINTAINING VALUABLE LONG-RANGE VISIBILITY

Although my testimony will deal with a range of different EPA related issues, if they contain a common thread, it is that there are gaps in the strategies for maintaining clean air and long-range visibility in New Mexico. Long-range (70-100 mile) visibility is of great economic value in our region and state. Because I realize the anecdotal evidence of this gained by looking out the window is insubstantial in a hearing transcript, I cite several studies (summaries attached). A recent study by the Institute of Policy Research, University of Wyoming, showed Americans were willing to pay $5.8 billion per year (1980$) for the protection of long-range visibility in the great recreational areas of the Southwest. A poll by the Public Service Co. of New Mexico found that "more than three-fourths (of their customers) consider the $120,000,000 in pollution control equipment at the San Juan Generating Station to be worth the money."

What are some gaps in the legal strategies in place for maintaining this valuable state and regional asset? An essential tool for addressing visibility impacts of proposed new plants is a mathematical model for predicting impacts before the fact. EPA's official position is that none of the existing models for estimating visibility effects is acceptable. Yet, at the same time, EPA has halted all funding for research to develop an acceptable model. One or the other of these positions clearly must be changed if problems of future visibility degradation are to be addressed rationally.

The three succeeding points also are problem areas that contribute to needless degradation of visibility if left unsolved.

II. GROWING NO_x EMISSIONS FROM INDUSTRIAL SOURCES

State-contracted studies ("History of Air Pollutant Emissions in New Mexico," Trijonis, Davis, and Hamm, Santa Fe Research Corp., October 1982) document clearly that the remaining unsolved air problem in the years ahead for New Mexico is NO_x emissions. Despite industrial growth, the application of abatement technology has very substantially reduced statewide emissions of SO_2 and particulates (Trijonis, Fig. 1 and Fig. 2). However, due to the historical lack of effective abatement technology for NO_x, NO_x emissions have grown with industrial growth and continue to grow (Trijonis, Fig. 3). In the future, the brown plumes of NO_x emissions from large industrial sources, especially coal-fired sources, can be expected to become increasingly familiar to New Mexicans as the overcovering emissions of SO_x and particulates are stripped away by abatement. Also, in the absence of requirements to use advanced technology like Selective

Catalytic Reduction (SCR), the expansion of electric power production will bump first against the ambient limits for NO_x. To remove this limitation, we urge EPA and Congress to move quickly to bring SCR processes into widespread use on new sources in our region. This could be done in the PSD permitting process or in technology demonstration projects.

III. VAGUENESS IN DEFINITION OF "BEST AVAILABLE CONTROL TECHNOLOGY"

New Mexico is preparing to take over from EPA implementation of its permit program for Prevention of Significant Deterioration (PSD). In fact, a state hearing on PSD rules will be held tomorrow. In view of the previously mentioned high value of long-range visibility in our region, this is a program critical to maintaining valuable economic resources of our state. To my mind, the use of Best Available Control Technology (BACT) as suggested in PSD regulations is, and always has been, the key to resolving conflicts between industrial and recreational uses of clear air.

However, the key is in achieving (for large sources) truly the "best" technology or something reasonably close to the best. Present Federal and similar, proposed state definitions of BACT are too loose to ensure progress in employing BACT. The definitions say "BACT" means achieving the maximum degree of pollutant reduction achievable "taking into account energy, environmental, and economic impacts." We have no quarrel with including economic considerations, but the language is too vague. Firstly, allowing both "energy" and "economic" considerations constitutes double counting. All "energy" impacts appear, and can be stated, as "economic" impacts. Whether it is energy consumed for control or an energy shortfall or disuse claimed due to control, the impact is economic or, if not, there is no justification for anybody caring about "energy" factors having no imaginable economic impact either now or later.

Secondly, and more importantly, what are the guidelines for "taking into account" economic impacts? Experience in other states (see attachments concerning PSD, Creston, WA) tells us industry's idea of taking into account economics consists of pointing out the obvious fact that best controls (such as 95% sulfur removal on coal-fired power plants) cost more than minimum controls (such as 70% SO_2 removal required to meet ambient standards and New Source Performance Standards), perhaps identifying some million dollars cost difference between NSPS and BACT, and then seeking NSPS for BACT because of "economic impact." Clearly this path makes a farce of, and eliminates, the concept of BACT in PSD rules. What is needed is something, some guideline, to which the cost difference must be compared. One suggested guideline is the cost difference (between NSPS and BACT) incurred in cases where true BACT was actually achieved elsewhere. EPA or Congress could help formulate such guidelines to make BACT meaningful and understandable to all.

IV. CRIPPLED ENFORCEMENT POWER OF STATE

As a result of aggressive litigation to avoid controls taken by polluters in the sawmill industry (Duke City Lumber Co.) and a succeeding, sympathetic court decision, the State's power of enforcement of clean air rules has become an awkward, nearly impotent, aberration. The decision is this. On an appeal of a variance denial, an appellate court ruled a variance *must* be given the source unless a "hazard to public health" attributable to emissions from the source is established. The EPA administrator well knows the implications for enforcement from such distortion of normal procedures. Imagine, *after* hearings and appeals to establish ambient air standards, *after* hearings and appeals to establish emission regulations designed to meet those standards, and *after* substantiation by the State of source violations of those regulations and State and Federal standards, *then* the State must demonstrate uniquely a link between human health damage and the emissions from that source before clean air rules can be enforced. We seek help either from the Federal EPA or Congress to restore normal enforcement procedures to New Mexico.

V. UNEVEN RELATIONS WITH EPA

The very substantial progress in reducing NM air pollution (Trijonis, loc. cit.) has been won by hard and sustained efforts of the state, citizen environmental groups, volunteer contributors, pro bono legal help, and some companies. This is not to say the latent threat of EPA action did not play a large role in the success of local action, but the threat remained just that -- latent.

Our relations with EPA throughout these 14 years of New Mexico actions and successes might best be described as "uneven". The demeanor of EPA towards us has varied from helpful to solicitous to condescending, to openly hostile in more recent years. On two occasions (issues with Arizona Public Service Co. and Molycorp), settlement agreements were reached among the state environmental agency, New Mexico Citizens for Clean Air & Water, the Rio Grande Chapter of the Sierra Club, the polluting industry, and in one case even the U. S. attorney's office on behalf of EPA. Despite this broad support, these agreements encountered substantial reluctance and delay before getting EPA's approval, which in one case required for resolution a stated deadline from us by which NMCCA&W would announce suit against EPA for breach of contract. These difficulties spring more from inaction, inconsistency and constantly-changing EPA personnel than from any irreconcilable differences of opinion between us.

VI. ADDITIONAL IMPORTANT CONCERNS

For thoroughness, I will mention, without support, sundry other important air issues for New Mexico. The concept and adequate protection of Integral Vistas remains of high importance in helping protect our long-range visibility.

Although both of New Mexcio's copper smelters are achieving or soon will achieve 90+% control of SO_2, it remains critical to regionwide visibility to bring all Southwestern smelters under control without further extensions. Writing into the law now a fixed absolute deadline for smelter compliance would be appropriate to aid worker and company planning.

Acid rain studies should continue in the West, while sulfur emissions are held in check and work on NO_x emissions proceeds.

A limitation on NM PSD rules set by the state legislature is the exemption from PSD of any source excluded from Federal PSD rules. This limitation presently excludes from PSD considerations two potentially significant, future sources -- coal gasification plants and geothermal plants. Inclusion of these sources in the Federal list would solve the problem.

Thank you for coming to our state and for listening to our views. I would be happy to answer questions and provide more documentation on points critical to your deliberations.

Dr. John R. Bartlit
State Chairman
NEW MEXICO CITIZENS FOR CLEAN AIR &
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Los Alamos, New Mexico 87544
(505) 672-9792 or 667-5419

New Mexico Citizens for Clean Air and Water
113 Monte Rey North, Los Alamos, New Mexico 87544
July 11, 1983

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS HEARING ON

STATE OF THE ENVIRONMENT: A NEW MEXICO PERSPECTIVE

1:00 PM -- WEDNESDAY, JULY 6, 1983

ALBUQUERQUE CITY COUNCIL CHAMBERS CITY HALL

ALBUQUERQUE, NEW MEXICO

SUPPLEMENTAL COMMENT FROM

NANCY R. BARTLIT
COORDINATOR, NEW MEXICO CLEAN AIR COALITION

NEED FOR ACID DEPOSITION STUDY FOR NEW MEXICO

An informal group of professionals who work in air quality matters in New Mexico meets about every six months to share information and to discuss issues. They represent the New Mexico Air Quality Bureau, Environmental Improvement Division; National Park Service, Bureau of Land Management, Los Alamos National Laboratory, New Mexico Technical Institute at Socorro, Public Service Co. of NM, NM Citizens for Clean Air and Water, and the Rio Grande Chapter of the Sierra Club.

One of the important issues with which this informal group has dealt is acid deposition and its possible adverse effects on sensitive receptors. Scientists at NM Tech have been working in this field for about ten years. Studies have been ongoing at UNM as well.

National Atmospheric Deposition Stations (as part of the nationwide program) have been set up in New Mexico at:

1) Bandelier National Monument - with equipment and chemical analyses paid for by LANL and regular measurements made by NPS personnel.

2) Cuba, NM on U.S. Forest Service land with equipment and chemical analyses paid for by BLM.

Other acid deposition monitoring programs are located at:
1) Mountains near Socorro operated by NM Tech,
2) PNM monitors near San Juan.

Proposed stations are located at:
1) Gumo - Guadalupe Mountain National Park, Texas near the NM border. This station is to be instrumented by the Inter-Departmental Acid Deposition Program and will link with the NADP. They pay for chemical analyses, too.
2) Chaco Culture National Historical Park, NM. Equipment will be provided by the State of NM, Air Quality Bureau which will also pay for chemical analyses, as well.
3) Ski Basin above Santa Fe. Operated by the State of NM, Air Quality Bureau.
4) An area near Cloudcroft (Sunspot?). Operated by BLM.

These provide a continuous record of current pH and chemical concentrations in wet deposition.

However, other studies are needed:
1) To determine the extent, if any, of air pollutants and acid deposition materials' impact(s) on sensitive "receptors" such as lichens, plants, rock art (especially pictographs), animals, etc.
2) The quantitative extent of the buffering effects of alkaline soils found in NM and the duration and distribution (both spatial and temporal) of this buffering capacity; i.e. how extensive is this buffering "bank account"? how long can we hope to "draw against" it?

It is imperative to research these latter two important questions in order to replace current rhetoric with quantitative facts! NPS, locally, has been seeking funding from its nationwide science program in order to do this but has not been successful to date. Apparently, these needs have not been determined to be of high enough priority, as yet, in the NPS science program. This should be changed.

Furthermore, studies on the following need to be made:

1) Determine the trends (over time) of acid deposition impacts, especially on crops, forest products, etc. and impacted, as well as impacts on wilderness areas, parks, etc.
2) Perform trajectory analyses to determine sources of pollutants. (NPS now has the capability to do this type of modeling analysis; for both case-by case/short duration episodes and for long term (seasonal, annual, etc.) situations of occurrence.

In order to provide a complementary service to these governmental agencies, the Los Alamos Mountaineers, NM Citizens for Clean Air and Water, and now the trekkers of the American Lung Association of NM have been collecting baseline data on the acidity of high mountain lakes and streams in a very controlled test program which is coordinated with the National Center. Information from all the above stations and tests are informally exchanged among the groups, but there will be an effort to centralize this information through the State Bureau.

We appreciate this opportunity to place this information into the record for the use of the U.S. Senate Committee and for William Ruckelshaus of EPA. We feel the collection of information regarding environmental problems in New Mexico would be incomplete without some comment on the excellent cooperative efforts of all involved and interested in this very important issue confronting the northern American continent and, indeed, the entire world. Thereare very sensitive high mountain regions susceptible to acid deposition that should be protected. Besides, we do not wish to wait until the situation precipitates severe impacts before the state responds to correcting potential sources of acid deposition.

N. Bartlit

METHODS DEVELOPMENT FOR ENVIRONMENTAL CONTROL BENEFITS ASSESSMENT

Volume VIII

THE BENEFITS OF PRESERVING VISIBILITY IN THE NATIONAL PARKLANDS OF THE SOUTHWEST

by

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OFFICE OF EXPLORATORY RESEARCH
OFFICE OF RESEARCH AND DEVELOPMENT
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WASHINGTON, D.C. 20460

ABSTRACT

The nation needs to know how much visibility is worth in order to evaluate the benefits of air pollution control for the purpose of visibility protection. This study was designed to measure the economic value of preserving visibility in the National Parklands of the Southwest. During the summer of 1980, over six hundred people in Denver, Los Angeles, Albuquerque and Chicago were shown sets of photographs depicting five levels of regional visibility (haze) in Mesa Verde, Zion and Grand Canyon National Parks. Although our calculations suggest that projected emissions with existing and currently planned SO_2 controls would *not* produce a perceived decline in visibility, complete decontrol of SO_2 emissions by projected power plants in the region in 1990 would result in a decrease in typical summer visibility from that which was represented in the photographs as "average" visibility to that which was represented as "below average" visibility. On the basis of this, the survey participants were asked how much they would be willing to pay in higher electric utility bills to preserve the current average condition--middle picture--rather than allow visibility to deteriorate, on the average, to the next worse condition as represented in the photographs (an estimate of total preservation value). They were also asked about their willingness to pay in the form of higher monthly electric power bills to prevent a plume from being seen in a pristine area. To represent plume blight, two photographs were taken from Grand Canyon National Park, one with a visible plume. The surveying had a very high response rate (few refusals). Individual household bids ranged from an average of \$3.72 per month in Denver to \$9.00 per month in Chicago for preserving visibility at the Grand Canyon. These average bids were increased by \$2.89 to \$7.10 per month per household in the four cities if visibility preservation was to be extended to the Grand Canyon Region as a whole as represented by the photographs taken from Mesa Verde and Zion. Prevention of a visible plume at the Grand Canyon was worth on the average between \$2.84 and \$4.32 per month for the four cities surveyed. Extrapolating these bids to the nation implies that preserving visibility in the Grand Canyon Region is worth almost 6 billion dollars per year. This is the base figure from which the benefits of power plant SO_2 controls, projected to be in place in the region in 1990, are determined. Adjusting this number for 1990 population levels and using a 10 percent discount rate over a thirty year power plant life gives an annualized value of 7.6 billion dollars as the benefits of power plant SO_2 control. The corresponding control costs are estimated to be approximately three billion dollars annually. Therefore, the existing and proposed control level in the Region is not without economic justification. Additionally, prevention of a visible plume at the Grand Canyon is worth almost two billion dollars to the nation. These results suggest that preservation values derived from knowledge that a unique natural wonder remains preserved may be very large for the Grand Canyon Region. Finally, the methodology used must be considered experimental since this is the first study, to our knowledge, to include an estimate of preservation value for a unique national treasure.

HISTORY OF AIR POLLUTANT EMISSIONS IN NEW MEXICO

by

John Trijonis
Marilyn Davis
Barbara Hamm

Santa Fe Research Corporation
Santa Fe, New Mexico

October 11, 1982

REPORT FOR THE ENVIRONMENTAL IMPROVEMENT DIVISION
OF THE STATE OF NEW MEXICO

in partial fulfillment of
Contract No. 70/665/51/031.40

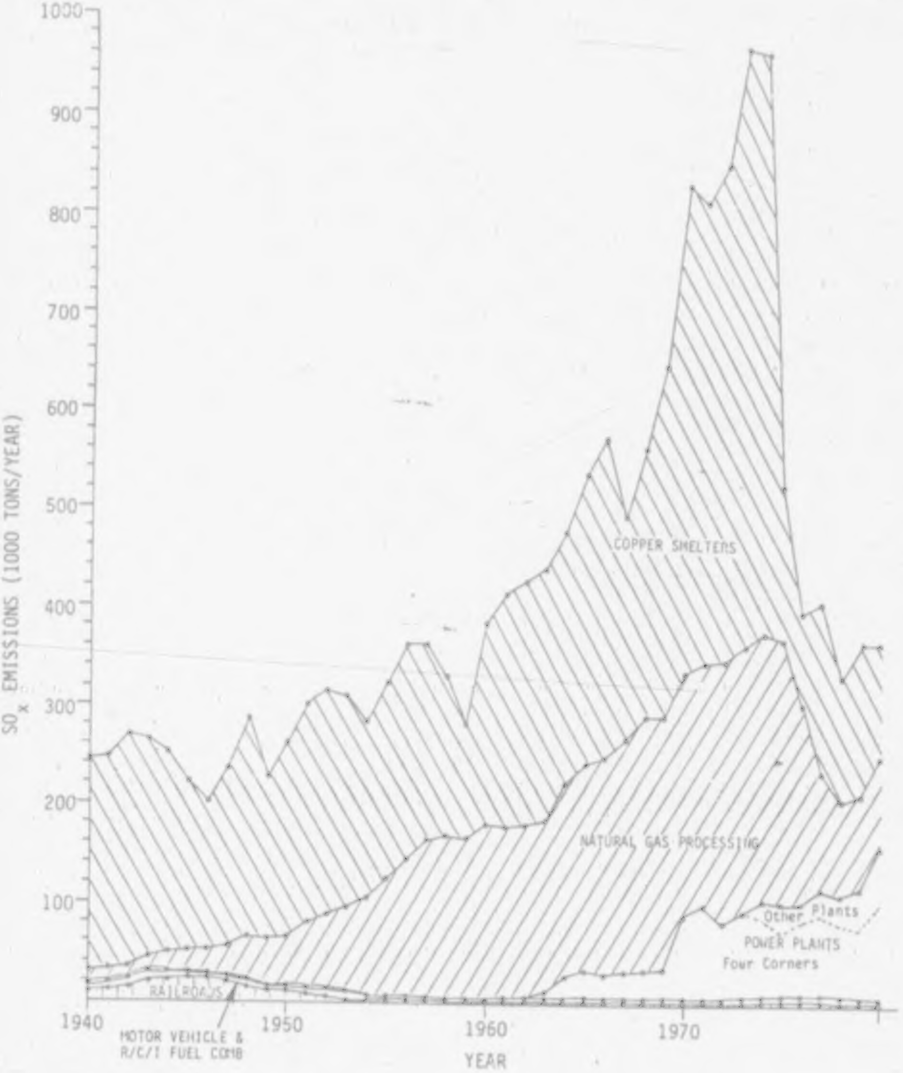

Figure 1. Historical SO_x emissions in New Mexico, 1940-1980.

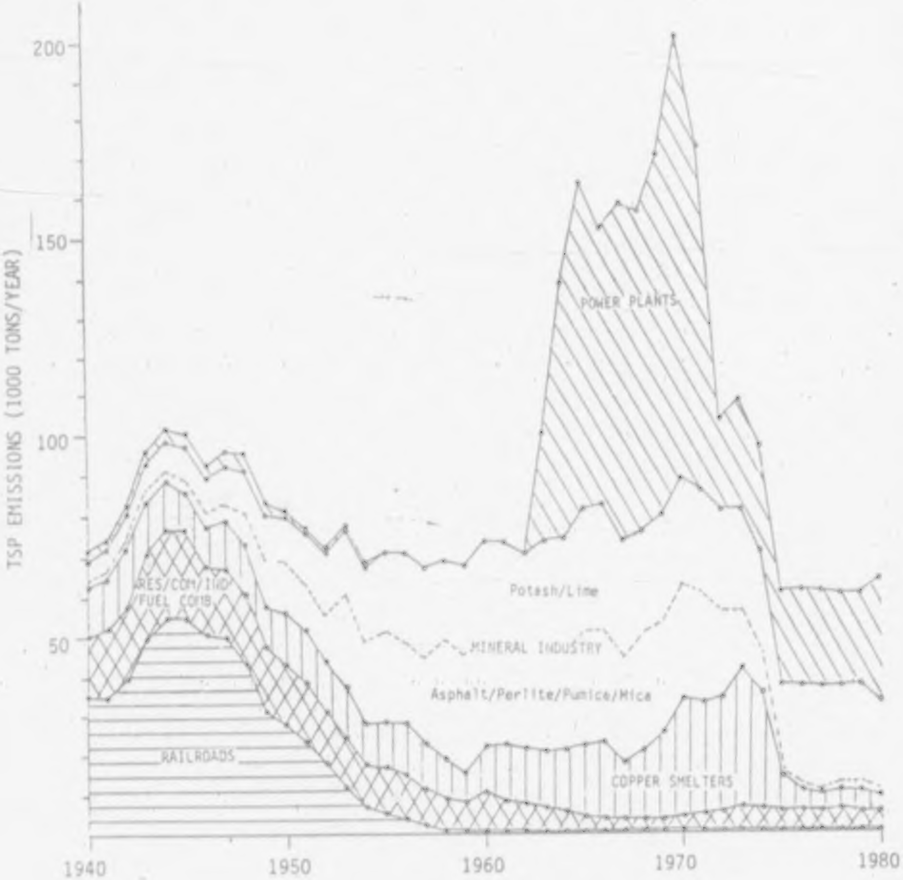

Figure 2. Historical TSP emissions in New Mexico, 1940-1980.

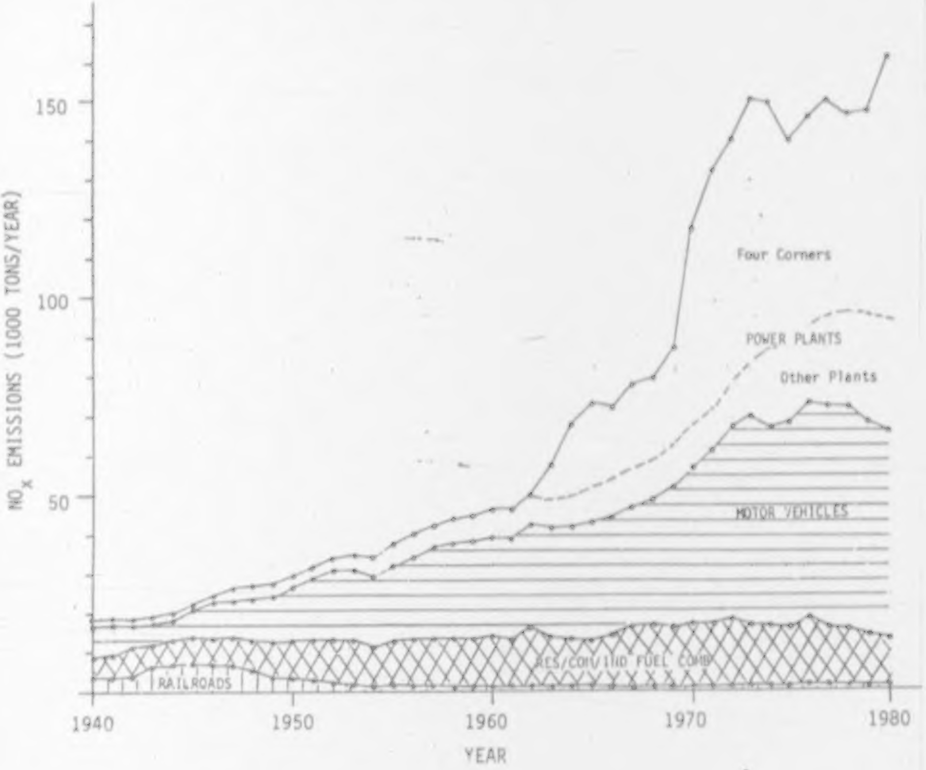

Figure 3. Historical NO$_x$ emissions in New Mexico, 1940-1980.

FINAL

ENVIRONMENTAL IMPACT STATEMENT

CRESTON GENERATING STATION

A Joint Federal/State FEIS Prepared By

Bureau of Reclamation
U.S. Department of Interior

and

Washington State Energy
Facility Site Evaluation
Council

Assisted By

Bonneville Power Administration
Department of Energy

Rural Electrification Administration
Department of Agriculture

Interstate Commerce Commission
Department of Commerce

as Cooperating Agencies

Response 553: Sixth paragraph: Change to read:

"a. 90% control for high sulfur coals and resultant emissions at or below 1.2 pounds SO_2 per MMBTU.

b. 70-90% control for medium sulfur coals and emissions at 0.6 pounds SO_2 per MMBTU.

c. 70% control for low sulfur coals and emissions at or below 0.6 pounds SO_2 per MMBTU.

The degree of control required can be estimated given the coal heat content (~9000 BTU/pound curve) and the coal percent sulfur (worst--0.73% sulfur corresponding to 0.843 pounds $SO_2/10^6$ BTU). The NSPS would only require 70% SO_2 removal for the coal proposed. This level of control would result in 0.506 pounds SO_2 per MMBTU emission."

Page 3-15, DEIS

Responses 160, 214 and 651: Sixth paragraph. Insert the following paragraphs:

"APPLICANT BACT PROPOSAL

In the Applicant's revised Application for Site Certification (WWP, 1981, amended January, 1982), the Applicant proposes to purchase an FGD system capable of attaining up to 86.5 percent SO_2 removal on a 30-day rolling average. Each FGD system would be operated at removal efficiencies varying from 70 to 86.5 percent depending upon the number of units in operation, their level of operation, and the sulfur content of the coal being fired. These removal efficiencies would allow the CGS to comply with a plant-wide SO_2 emission limit of 4,560 lb/hr and a per-unit SO_2 emission limit of 2,764 lb/hr. The Applicant has proposed this as Best Available Control Technology (BACT). An alternative that was originally proposed by the Applicant and that was analyzed in the DEIS is operation of each unit at 86.5 percent SO_2 removal efficiency. Maximum SO_2 emissions under the Applicant's BACT proposal would be equivalent to SO_2 emissions from operating each unit with 86.5 percent SO_2 removal efficiency when the four units are operating at a combined maximum guaranteed rating (570 MW per unit) and burning Coal D (worst case for sulfur of the coals being considered).

Under both alternatives (the Applicant's BACT proposal and the original proposal of operating each unit at a fixed 86.5 percent SO_2 removal efficiency), short-term environmental impacts on air quality (state and Federal AAQS, Federal PSD Standards) would be the same as those evaluated in the DEIS. Since concentrations would remain well within Federal and state standards, environmental changes are expected to be negligible.

Long-term emissions of SO_2 would be greater for the Applicant's BACT proposal than for that of the alternate for two reasons:

Long-term emissions of SO_2 would be greater for the Applicant's BACT proposal than for that of the alternate for two reasons:

- for the first six years after start-up of Unit 1 and before start-up of Unit 4, more SO_2 would be released because the existing units would be allowed to operate with less than 86.5 percent SO_2 removal efficiency (but greater than 70 percent as required by NSPS).
- with all four units complete, the plant might consistently emit closer to the 4,560 lb/hr limit for all 8,760 hours per year, as shutdown of any units for planned maintenance or emergency could be compensated by reducing scrubber efficiency for the remaining units.

Theoretically, this provision could result in up to one-third greater annual emissions during the operational period of the plant. However, practical difficulties in short-term adjustments of SO_2 removal equipment exist, making this potential one-third greater annual emissions highly improbable. The actual difference in emissions and resulting annual concentrations that would occur cannot be predicted, because actual operating experience with the installed SO_2 removal systems would determine the potential for adjustments.

Even if the annual emissions increased by one-third, annual average concentrations would remain below threshold levels known to cause detectable damage to vegetation. Annual concentrations would remain in compliance with Federal and State air quality standards for SO_2.

The uncertainties would be the same for both alternatives regardless of whether fixed or variable SO_2 control were used. These include the effect of the CGS on increased acid deposition, fine particle (sulfate aerosol) formation, and long-term chronic consequences. The variable control proposed schedule may cause any possible impacts to appear sooner than with fixed control. Should effects begin to appear, the same mitigating measures would be considered as for a fixed control system, with the possible addition of switching from variable to fixed SO_2 control.

According to the Applicant, a number of resource and cost savings would accrue from operating the CGS during the first six years of operation under the BACT proposal (variable SO_2 removal) than with the alternative (fixed 86.5 percent SO_2 removal for each unit). Over the initial six years of operation, the savings shown below:

Resource	Total Resource Savings
Sludge disposal area	2.7 acres
Electrical power	447.8×10^6 kWh
Process water	287.5×10^6 gal
Limestone	76,650 tons
Coal	380,880 tons

Source: WWP, 1982 "CGS Supplemental BACT Analysis and Proposed Permit Conditions"

On the other hand, the Applicant's BACT proposal would result in about 35,000 tons of SO$_2$ emissions greater during the six year period than with the fixed 86.5 percent SO$_2$ removal alternative.

Boiler particulate emissions (flyash) would be controlled using a baghouse, with the following characteristics:

- multicompartmented
- air cleaned
- suction designed
- bag filters of woven fiberglass, pre-coated with flyash
- designed to meet the 0.03 lb/MMBTU New Source Performance Standard
- thermal control to avoid moisture condensation

TWWPCo has indicated that use of an electrostatic precipitator for particulate control may also be considered at a future time.

Fugitive dust, generated by coal, limestone and flyash handling and storing, would be minimized by:

- reducing the number of material transfer points, to limit the amount of dust generated by material disturbance
- enclosing the material transfer points
- reducing the material transfer points
- compacting ash storage piles to decrease dust generation by wind erosion
- storing limestone in silos
- storing coal (live) in enclosed structures
- wetting selected areas to decrease dust generation
- installing baghouses at selected areas
- chemically stabilizing work roads

Control systems that are being considered to limit NO$_x$ emissions from the boiler, to comply with New Source Performance Standards, are:

- reduced total available oxygen for combustion
- reduced reaction temperatures (by furnace sizing)
- staged combustion

Final determinations of BACT will be made by EPA and EFSEC. These are not currently available, so they cannot be incorporated into the FEIS."

Response 554: Last paragraph, second sentence. Change to read: "One case where the CGS impact do combine with another source is for particulate levels added to the estimated impacts for the proposed Mt. Tolman and Molybdenum Mine."

SOUTHWEST RESEARCH AND INFORMATION CENTER

The State of the Environment: A New Mexico Perspective

A Southwest Research and Information Center Perspective

Testimony before the US Senate Committee on Environment and Public Affairs

Albuquerque, New Mexico

July 6, 1983

Prepared by:

Wm. Paul Robinson
Executive Director

Thank you for the opportunity to present this testimony concerning the "The State of the Environment:A New Mexico Perspective". My Name is Wm. Paul Robinson and I am Executive Director of Southwest Research and Information Center, a non-profit scientific and educational organization working on a wide range of regional energy and environmental issues of both local and national importance. The Center has played a consistent advocacy role for the last dozen years in most of the questions being addressed today. Southwest Research maintains projects related to Water and Mining, Coal and Utilities, Nuclear Waste Disposal and Radiation and Health. New Mexico plays a major role in the each of these national environmental questions, one of the main reason SRIC continues to work on them over the years.

This testimony is intended to address several key issues in which New Mexico people and decision-makers play dominant roles. With the limited amount of time available for oral presentation at this hearing I will address major New Mexico based environmental questions, with which my staff and I are very familiar but are not likely to be addressed in depth by other witnesses today. These include matters related to Uranium Mill Tailings and EPA Waste Repository Standards.

Before discussing those matters, I would first like to comment a range of current questions of national scope concerning EPA performance in the post-Burford period. The performance of the EPA, and the Congress people who are supposed to monitor their work, on these issues over the next year will determine if EPA is able to recover its environmental "protection" role or lose that role to the window dressing and shallow enforcment that is Ms. Burford's legacy.

These comments make the following points:

The basic New Mexico perspective is that New Mexicans are forgotten in the national environmental debates of Washington, DC. To often the "remoteness" of the southwest, leaves us victim to the poor site selection and delayed, ineffectual enforcement that allows the contamination of growing areas of the Land of Enchantment. Examples abound, from EPA's failure to disclose and begin to cleanup a hazardous waste site on Albuquerque's West Mesa while the investigation of other sites used the the operators in other states slowly roled on. Albuquerque's effort to site a sewage sludge storage and handling site in the flood plain of Tijeras Arroyo above the Mountain View is a excellent example of EPA funding, with Clean Water Act money, a disaster waiting to happen. These are just two examples of EPA, within the last year of EPA giving New Mexicans the short end of the deal.

But of course, most environmental question must be addressed from a national perspective if changes are going to happen locally.The following comments provixce some New Mexico views of national environmental issues:

*The budget for EPA, and environmental activities of other Federal agencies, needs to be strengthened to recover lost enforcement, research and implementation performance. Debate in Congress has centered on whether the EPA budget will reach 1981 or 1972 equivalent levels, neither are years of particularly effective environmenal protection activities, just dates from which to measure the national environmental loses.

*Southwest Research and Information Center supports forceful implementation of the Clean Water and Clean Air Acts in a form similar to the current language. Lack of enforcement and loss of staff over the last three years has but EPA behind on many important air and water quality milestone. Changing the rules in midstream, after a dozen years of court clarification, will delay implementation of the carefully written water and air acts.

*EPA has acted to clean up less than 10% of the "Superfund" hazardous waste disposal sites in the nation. This weak enforcement hasn't slowed the contamination that made the list in the first place. New Mexico's largest "Superfund" sites are uranium tailings piles, at Milan and Churchrock. EPA has been far in the background of enforcement at both sites, see discussion below.

*EPA has also fallen behind on Hazardous and Toxic waste disposal standards setting under the Resource Conservation and Recovery Act and the Toxic Substances Control Act. Both sections of EPA established under these statutes deserve greater attention, in terms of staff and rulemaking to meet their Congressional mandates. Failure to develop and implement those systems have left loopholes allowing both small and large generators of hazardous waste.

*SRIC has determined, based on our review of available research and testimony at EPA's June 15, 1983 hearing, that EPA's inactive and active uranium tailings standards are inappropriate and fail to meet the minimum requirements of the Uranium Mill Tailings Radiation Control Act of 1978, as amended. Discussion below identifies a reange of source for this review. Senator Domenici, has lead much of the effort to limit the range of those standards, but the EPA rules fail to meet even the amended goals, of the Uranium MIll Tailings Radioation Control Act. Actions listed below on these talings matters represent a good measuring stick to test the Senator's depth of committed to long term environmental quality.

*SRIC supports EPA's development of standards for nuclear waste disposal pursuant to The Nuclear Waste Policy Act of 1982, these standards should address transuranic waste repositories, of which the Waste Isolation Pilot Plant (WIPP) in New Mexico is the first in the nation and is wholely unlicensed.

The rest of this statement will address Uranium Mine and Mill Hazards and EPA Nuclear Waste Repository Standards.

Uranium Mine and Mill Hazards

EPA's recent rules proposed for uranium operations and tailings disposal, are substantial weaker, in every area other that groundwater protection, that rules for uranium site in New Mexico and Colorado, the major uranium rule making "agreement states". The strengthening those rules is a major envirnmental priority for the western uranium states, along with eastern states with uranium deposits, like Virginia.

EPA's responsibilities for uranium industry environmental matters are spread across several statutory authorities including: The Uranium Mill Tailings Radiation Control Act, as amended (UMTRCA or "the Tailings Act"); The Clean Water Act, as amended; The Clean Air Act, as amended; The Solid Waste Disposal Act, as amended (including the Resource Conservation and Recovery Act; and The Comprehensive Environmental Response Compensation and Liability Act (CERCLA, or "superfund"), at the least.

These comments will focus on active tailings disposal standards, the criteria that apply to the largest fraction of tailings in New Mexico and therefore, the nation. This should not be understood as limiting our interest, or the importance to New Mexico of the other tailings related actions EPA and the Committee are pursuing. These other activities are mentioned in the "Actions" section of this part of my statement.

Though each of these are major statutes, the Tailings Act is of prime focus because EPA is in the midst of broad reaching rulemaking activities contemplated by UMTRCA. EPA's activities cover licensed active uranium mill tailings, inactive or abandoned uranium tailings piles, and emissions and wastes from uranium mines. Congress found these uranium wastes "may pose a potential and significant radiation health hazard to the public" and "every reasonable effort should be made for stabilization, disposal and control [of these wastes] in a safe and environmentally sound manner". The 1978 Congressional conference report on UMTRCA noted "the committee does not want to visit this problem again with additional aid. The remedial action must be done right the first time." Under the 1982 Amendments to UMTRCA EPA, in its standard setting role, is cautioned to ensure that the costs of standards "bear a reasonable relationship to the benefits expected to be derived" while carrying out its "paramount responsibility" of protecting public health, safety and the environment.

New Mexico is the national leader in uranium production and uranium reserves and has been for more than ten years. New Mexico therefore is the leader in uranium mine and mill waste production. New Mexico retains more than 80 million tons of uranium mill tailings in five piles, three of which contain more than 25 million tons each, within 25 miles of each other. No other tailings pile outside New Mexico is even half the size of the 30 million ton pile at the Kerr-McGee-Ambrosia Lake site. When one is discussing uranium hazards and their costs of mitigation, the most important locality is this state.

New Mexico individuals, companies and agencies have benefitted greatly from this industry over the last three decades but that benefit is offset by the operator's paying a reasonable share of the cleanup costs for their facilities. Simply put, New Mexico uranium worth billions and billions of dollars has been produced without the reclamation of a single mill or mine site. Currently the three biggest uranium tailings piles in the US (Kerr-McGee, Homestake and Anaconda) are operating under licenses last renewed in

1971, and never renewed by the New Mexico licensing authority, the New Mexico Environmental Improvement Division. Though New Mexico has provided the largest share of the nation's uranium, the bulk of the rest of the production has come from Western states: Wyoming, Texas, Utah, Colorado and Arizona. Thus, reclamation matters are of major concern to New Mexico and those states with existing uranium dumps.

The standards EPA is proposing for tailings regulation address both inactive and active facilities. The lion's share of the tailings more than 75%, are in active piles, more than half of which are in the three big New Mexico piles. Thus though the standards setting has covered a wide range of modeling exercises, the extremely localized focus of the problem has been lost. This focus has not however been lost in the political arenas where the major operators have been aggresively pressing their position with New Mexico's congressional delegation evident from the legislative position taken by the delegation to date. It seems that industry has had plenty of extra capital to spend on lobbying and litigation, but none to cleanup the hazardous waste it has generated for 30 years.

Most noticably, the EPA analyses have failed to identify a reasonable range of the health based costs of uranium production. The EPA environmental and regulatory impact reports supporting the tailings rules calculated health costs only in terms of radon-daughter related lung cancers death using non-conservative parameters for calculation. For those familiar with the issue, radon related health effects are a very controversial and volatile technical subject with reasonable people differing on the "facts". However, there is little debate, and none before EPA, that the non-radiological health hazards associated with uranium production present a real and present risk to residents of uranium areas. These include such toxic heavy metals as zinc, lead, cadmiun, selenium, molybdenum, and arsenic. These chemicals, along with reagents such as sulfuric acid and sodium chlorate and radionuclides such as radium-226 and thorium-230, give uranium tailings and the verified contaminated seepage they have led to, a mixture of well documented risks, loose in the environment to challenge the worst hazardous chemical dump New Jersey can find.

Knowing this, it is very inappropriate for EPA to base it health benefits solely on lung cancer deaths only. Consideration of the health effects posed by all of the numerous and potentially synergistic radioactive elements in addition to radon and the trace heavy metals and chemicals of tailings, essential to any health based weighing of the effects of tailings or the costs of their reclamation.

These hazards are generated by radioactive materials produced over very long periods (tens of thousands of years) and non-radioactive contaminants which persist indefinitely. Thus tailings will maintain their hazardous nature for thousands of years and represent the major health risk of the nuclear fuel cycle, if calculated for tens of thousands of years. EPA on the other hand is proposeing to permit stabilization with a longevity of as little as 200 years, perhaps with engineered liners for seepage prevention. These longevity standards are wholely inappropriate to the problem and to the Congressional mandate to resolve the problem. The stabilization can, and has been, designed to respond to the "thousands of years" that these facilities will present major hazards to people. The examples also come from New Mexico: the two most recently licensed mills in the state - - Bokum and Gulf - - both employ stabilization plans which, when put into operation, will provide "thousands of years" of erosion and seepage protection via below-grade disposal and liners. The licensed plans for those facilities, though approved three years ago, still present a much better approach to the Congressional mandate to stabilize tailings "right the first time" than the EPA proposed program. The documentation to support these statements are included in SRIC's Oral Testimony, Comments and Supplemental Comments on EPA's Proposed Uranium Mill Tailings Standards, 40 CFR 192, subpart D, June 15, 1983, Denver, CO and June 30, 1983.

There are several key milestone for EPA and Congress concerning the rulemaking, authority and funding of the UMTRCA program in the next six to twelve months. These are the areas where the Agency and Congress can demonstrate a renewed commitment to remedying the hazards of uranium mill tailings. The rule we are concerned about being so out of line with statutory authority was generated during the time Anne Burford was EPA Administrator. Apparently, the viewpoint of the new Administrator has yet to reach the Office of Radiation Programs. It is high time it did. Certainly if SRIC staff can be of service to the EPA in this area we would actively respond.

Uranium mill tailings are worth mentioning from a "hazardous waste" standpoint as well. Two of the four "Superfund Priority List" sites in New Mexico are uranium mill sites, United Nuclear-Churchrock and Homestake-Milan. The attorney for both operators is on this panel, Stanley Crout. Both facilities are operating under expired but extended uranium licenses, and both have been subject to residents' lawsuits alleging damages from groundwater contamination emanating from the tailings piles. Though the contamination from both sites has been well reported, no reclamation plans are in place. Most recently, when New Mexico did finally get around to proposing enforcement actions to remedy the UNC contamination problem, the company quickly sued to overturn the actions as "abritrary and capricious".

In the case of Homestake, EPA first identified severe selenium contamination, associated with the tailings at the mill, exceeding drinking water standards in domestic wells in 1975! Eight years later, the license has yet to be updated and local residents, in a solidly pro-mining area, have been forced to go to court for their water supplies. No EPA "superfund" enforcement action has been brought. In the Churchrock situation EPA Region 6 staff working with NMEID staff have prepared an adminstrative order to acheive a "superfund" remedy at that site. Unfortunately, the order has yet to be acted on, six months later, by EPA. Even in these very clear cut situations where water has been contaminated by facilities with national notoriety, EPA has failed to enforce its statutory mandate.

The authorities for enforcement actions at these sites include not only "Superfund" and UMTRCA, but also the Clean Water Act. Both sites have had unpermitted discharges to "waters of the United States" through leaks or flood runoff or both. Yet water quality protection has become a resident's burden because of EPA's failure to enforce its rules. The conclusions New Mexicans draw from these two examples of EPA hazardous waste enforcement is that there is nothing there! Studies are done but left on the shelf as the contamination spreads. Clearly hazardous waste disposal enforcement action on these nationally prioritized polluters is needed, and quickly, to revive the faith of westerners in EPA environmental "protection" abilities.

In closing this discussion on mill tailings it is important to consider the the thousands of jobs which the tailings reclamation projects will generate in the severely depressed uranium mining districts of New Mexico and other western states. Currently the industry is operating at less than one-third of its 1978 capacity with recovery to only 80% of pre-1980 production levels not projected until 1995 or later by the New Mexico Energy and Minerals Department's 1982 Annual Report. Thus the jobs that tailings control can create to ~~could serve to employ~~ the miners now out of a job because of the lack of demand for uranium. The Tailings Act was adopted when a new uranium boom was projected. Now that that boom has not materialized, the jobs the reclamation can lead to are the best short term benefit from tailings control. Unfortunately, the standards setting process has taken five years since the passage of the Act and thousands of miners with the exact skills needed for tailings reclamation, are looking for work.

Actions

In the next six months to a year, EPA will be making a number of critical decisions on standards for uranium mining and milling. SRIC believes that the following EPA actions are necessary to preserve and upgrade the environment of New Mexico and most of the West:

*Active Uranium Mill Tailings: EPA should set national standards for the stabilization and disposal of uranium mill tailings at licensed, commercial processing sites which (a) provide for "thousands of years" of isolation, (b) protect groundwater resources from degradation by leakage from tailings ponds, and (c) consider the cumulative effects on people of releases of radioactive and toxic materials in mining and milling intensive areas. SRIC believes that the record of EPA's current rulemaking for the active sites clearly supports such stringent standards.

*Inactive Uranium Mill Tailings: EPA should reconsider the stringency of its final rule for disposal of uranium mill tailings at inactive processing sites, especially in light of the record of the current rulemaking for the active sites. At a minimum, EPA should drop any further consideration of less stringent standards for inactive or active tailings in areas EPA defines as "remote." The people and environment of New Mexico and the West have a legal and moral right to the same level of protection afforded populations and ecological systems in other areas of the country.

*Releases of Radon from Underground Uranium Mines: EPA should adopt stringent emission standards for releases of radon gas from underground uranium mines, consistent with the requirements of the Clean Air Act with regard to radionuclide emissions and the "ample margin of safety" test. EPA's proposed standard for underground uranium mines represents an unacceptably high risk (1 in 500) of death or debilitating injury and contends that compliance is not now achievable by industry. On the contrary, the available data suggests that a risk of 1 in million is more appropriate and that the available technology can reduce radon emissions from mines substantially, if not to zero, without exposing miners to increases in already hazardous levels of radon in the mines. (see Hearing Record, Proposed 40 CFR 61 subpart M, Testimony of Robert Yuhnke, and Chris Shuey, June 14, 1983, Denver, CO)

*Mine Waste Report: EPA is under a court order to report to Congress on the hazards associated with abandoned uranium mines and mine wastes. This must be done immediately, consistent with the court's finding in Sierra Club v. Edwards, et al. As soon as possible thereafter, EPA should take quick, effective, long-lasting remedial action at these sites, which are far numerous than inactive and active tailings piles, and which present the kind of nuisance hazards that clearly endanger people's health and safety. EPA does not need to be reminded that there are more than 350 abandoned uranium mines on the Navajo Reservation alone; the problem is of such magnitude that EPA can ill afford to wait any longer to implement Congress's concern with abandoned mines and their associated wastes.

Repository Standards

EPA has a standard setting role for nuclear waste disposal other than uranium mill tailings. Just as with tailings, EPA's has a deadline to develop these standards applicable to the rest of the nation's nuclear waste, under 40 CFR 191. For seven years EPA has been working to adopt this rule, but time is growing short as The Nuclear Waste Policy Act of 1982 requires these standards to be in place by January 1984.

SRIC has twice commented on the standards, and we congratulate the new EPA administration for having a second comment period on the proposed standards. While there are some good aspects of the proposed standards, there are major inadequacies which must be addressed in the final rule. SRIC submitted specific comments on the proposed rule with letters to the record dated May 1 and June 19, 1983.

For New Mexico, however, the major issue is the strength and applicability of the EPA standards to the proposed Waste Isolation Pilot Plant (WIPP). It is clear to SRIC, the New Mexico Environmental Evaluation Group (EEG) and any objective person that the WIPP site would be disqualified as a repository under the proposed standards, especially in light of the lack of multiple geologic barriers and the failure to comply with the natural resource assurance requirement.

Since it appears there will be no Nuclear Regulatory Commission (NRC) regulation of WIPP, the only applicable independent standards for WIPP will be the EPA standards. Thus, the people of New Mexico will be looking carefully at whether EPA makes a scientific or a political decision about the nature and applicability of the final standards. On their face, the 40 CFR 191 standards apply to repositories like WIPP, those for disposal of nuclear waste. However, since WIPP appears to conflict with at least two of the primary criteria proposed for 40 CFR 191, EPA appears to be uncertain as to the applicability of national standards to WIPP, a national repository.

In our view if EPA substantially weakens the standards or excludes transuranic waste facilities from being covered by the standards, it will be making a political decision, not one based on sound science and its statutory requirements. If EPA has scientifically sound standards, WIPP should be considered in terms of those standards, thereby prohibiting construction of WIPP because the site does not meet the EPA standard.

In this regard we would note with great concern the letter of March 4, 1983 from Mr. Glen Sjoblom of EPA to Robert Neill of the New Mexico EEG, which stated that EPA was not sure if the standards would apply to WIPP because it was not clear that it is a permanent repository. Such a position is not a sound one in that DOE's Final Environmental Impact Statement and Record of Decision on WIPP clearly indicate that WIPP is intended to be a permanent repository.

Actions

The Committee and the Administrator should make clear that the EPA standards will apply to WIPP; that scientifically sound standards are promulgated by January 1984 in conformance with The Nuclear Waste Policy Act of 1982 and that those standards will be enforced on transuranic waste repositories, the first construction for which has begun at WIPP.

This concludes my written comment for this hearing. If EPA or Committee staff have any questions or comment related to the matters addressed in this testimony please contact me, or my staff, at the address on the coversheet of this statement. Thank you for the opportunity to address these important NEw Mexico environmental matters. I hope they retain the attention of the Committee and the EPA beyond this field hearing.

SENATE COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS

HEARING ON
STATE OF THE ENVIRONMENT: A NEW MEXICO PERSPECTIVE
July 6, 1983

STATEMENT OF G. STANLEY CROUT

On Behalf of the
Uranium Environmental Subcommittee of the
New Mexico Mining Association

My name is Stanley Crout. I am with the law firm of Stephenson, Carpenter, Crout and Olmsted in Santa Fe. I am appearing on behalf of the Uranium Environmental Subcommittee of the New Mexico Mining Association. My undergraduate degree was in geology, and I have worked with the uranium industry on safety and environmental matters for many years. I will address my comments to uranium matters, although in a general sense, the same comments have applicability to other minerals. The New Mexico Uranium Environmental Subcommittee greatly appreciates this opportunity to provide its prospective of certain regulatory activities.

New Mexico has an especially important perspective of the uranium industry. It has long produced about half of the nation's uranium, and a significant portion of all produced in the free world. The uranium industry has been intensely regulated since its infancy. It was early recognized that if this mineral of great potential benefit to mankind was to be developed, it would have to be produced in a safe manner.

Since the 1950's, detailed regulations have been applied to release of radionuclides from uranium mills to air and water. These were developed by the Atomic Energy Commission, the Nuclear Regulatory Commission, and the New Mexico Environmental Improvement Board. New Mexico is an agreement state, and uranium mills are regulated by the Environmental Improvement Board, with the advice and consent of the Radiation Technical Advisory Committee. The industry knows of no scientific data that shows compliance with these standards do not protect the public health. Discharges to streams have been regulated by EPA since the middle 1970's. Discharges of radionuclides and other elements to groundwater are closely regulated by the New Mexico Water Quality Control Commission.

Thus, the uranium industry accepts and is accustomed to elaborate regulation. Even so, several recent proposals and actions by EPA are such a drastic departure from reasonable and appropriate regulation that the viability of the domestic uranium industry has been questioned. These proposals and acts of EPA are based, I believe, on a lack of factual understanding of the facilities regulated, and reliance instead on extreme speculation and personal bias. The uranium industry strongly supports regulations that will protect the public health. It cannot survive regulations based upon anti-nuclear bias and scientifically unfounded prejudice.

Three recent EPA activities merit particular mention. These are:

1. The EPA proposed standards for uranium milling; both active and inactive
2. EPA's application of the Superfund to active milling sites
3. EPA's proposed limitations on radionuclide releases to air

In addition, the status of federal payment for the reclamation cost of uranium tailings generated for the national defense program is very important to New Mexico.

EPA's Proposed Standards for Active and Inactive Uranium Mills

The Uranium Mill Tailings Radiation Control Act, and subsequent amendments, provides for EPA to develop standards for active and inactive uranium mills. The Nuclear Regulatory Commission is to apply these standards in states, such as Wyoming, where it regulates uranium milling. The agreement states, such as New Mexico, where the states regulate uranium milling, are to adopt similar regulations to the extent practicable.

NRC acted prematurely, and attempted to adopt extremely unjustified restrictions in 1980. The Courts and Congress have suspended application of NRC's regulations. EPA has now proposed regulations for active mills that are not justified from any health consideration. EPA has adopted regulations for certain inactive mills which are also without health justification, and those are now being challenged in the courts.

I will discuss two of the most unjustified of EPA's proposals for active mills.

The first is EPA's proposed requirement concerning the amount of dirt and rock that must be placed on top of the tailings pile for stabilization after a uranium mill has served its useful life and operations have ended. EPA proposes that sufficient cover be placed upon the tailings to limit radon emissions for up to 1,000 years, but not less than 200 years, to 20 pico curies per square meter per second. This is to be measured, not at a place where radon would reach the public, but on the tailings pile itself. Roughly, this may require about ten feet of dirt be placed upon the tailings pile. The radon discharge of 20 pico curies per square meter per second is far less than the amount of radon release that is permissible during the operating life of the mill, which in many cases is 20 years or more.

The environmental damage that will occur from placing this much cover over tailings ponds is very great. The New Mexico Environmental Improvement Division in testimony before a Subcommittee of the House Armed Services Committee, estimated that approximately 23,000 acres of New Mexico will have to be denuded of soil to provide the cover to place on tailings ponds. What is the health justification for such treatment? EPA has claimed that if the tailings piles are not covered there is a hypothetical increased cancer death risk from radon emissions of 5 persons per year. This is an exceedingly small hypothetical risk. For example, the risk compares with other common risks as follows:

Cause	Average Individual/risk year
Uranium Tailings, all uncovered	1 - 50,000,000
Smallpox vaccination	1 - 330,000
One pint of milk per day	1 - 100,000
Motor vehicle (1975)	1 - 4,500
Air Travel - One transcontinental flight per year	1 - 330,000
Lightning	1 - 2,000,000
Tornado	1 - 2,000,000
Pedestrian (1975)	1 - 25,000

Even so, this estimate of risk greatly overstates the actual risk because it is based upon a number of unjustified assumptions. In fact the actual risk is far less than one per year if the tailings were not covered at all. This compares to 111,000 lung cancer deaths per year from other causes. For example, EPA arrives at the risk estimate on the assumption that no cover at all will be placed upon tailings. This is ridiculous. New Mexico has the majority of tailings in the United States and the New Mexico Environmental Improvement Board has regulations requiring sufficient cover to be placed upon the tailings at the ends of operations to comply with the radon release requirements established by the Atomic Energy Commission, the Nuclear Regulatory Commission and the New Mexico Environmental Improvement Board. These regulations which limit radon concentrations at the property line, have been found by the federal and state agencies to protect the public health from any radon releases. The few feet of cover required to be placed on tailings by the New Mexico Environmental Improvement Board will limit radon emission to levels where there is no increased cancer risk. The 10 feet resulting from the EPA proposal is not necessary at all.

Another example of the error in the EPA risk calculations is the assumption of the linear non-threshold model, which states that very small concentrations of radon will have proportionally the same health effects as very high concentrations of radon. There is no scientific justification for the application of this model, and some recent studies have indicated that very small concentrations of radon may have beneficial effects.

Even if one were to assume that the EPA risk estimates for the worse case were correct, the restrictions EPA proposes are not justified. This is because the EPA assumes that once the tailings are turned over to the federal or state governments, as required by the

Uranium Mill Tailings Radiation Control Act of 1978, that the government will not do its job in restricting access and use of the tailings. EPA has acknowledged there is very little danger from the tailings themselves. EPA rates the risk from misuse of tailings, for example, for milling purposes, to be 12 times higher than the danger from the radon from tailings. What EPA is attempting to require is that the companies spend a huge sum of money so that the government, after it owns the tailings at the end of operations, will not be negligent in its stewardship of the tailings. For example, EPA in part attempts to justify the amount of cover by assuming that graves are going to be dug into the tailings. Since many graves are six feet deep, EPA wants enough cover so that the grave diggers will not dig down into the tailings. This is preposterous.

EPA also uses the justification that people will cut down the fences and use the tailings for building material. There is a huge federal establishment in New Mexico devoted to the protection of federally owned property. This establishment is very vigorous in protecting federal property which constitutes the majority of all property in New Mexico. Furthermore, there is no shortage of sand in New Mexico from other more convenient and desirable sources to provide building material. There is simply no history of this practice in New Mexico to make it a serious consideration.

The EPA further attempts to justify the amount of cover on the theory that at some later time the federal government will determine that the amount of cover EPA proposes is not needed. Thus, the present EPA personnel wish to assure their own biases will be perpetuated in a fantastically expensive monument to prejudice that will prevent future administrations from applying reasonable regulations.

The cost of this program will be enormous in New Mexico. Estimates range in the neighborhood of $200,000,000 or more. At the same time, the federal government is vigorously advocating and supporting programs to better insulate the houses in the United States to increase fuel efficiency. Of course, better insulation increases the natural radon concentration in the houses and the increased risk from the federal program of better insulation for houses is estimated to have increased the cancer death risk by 1,000 Americans per year, vastly more than even the wildest estimates of the effect of mill tailings. If continued, the federal insulation program is estimated to cause 10,000 additional cancer deaths per year.

The EPA's regulation also ignores the very commendable program in New Mexico of a perpetual care fund for uranium mill tailings. The companies pay $.10 per lb of uranium concentrate milled to a fund maintained by the state. No single company's concentration exceeds $1,000,000. This fund is used by to properly maintain the tailings after the ownership is turned over to the state government at the end of operations. This fund now exceeds $5,000,000. The interest on the fund alone will generate a far larger amount of money than necessary to maintain the tailings after they have been stabilized and turned over to the appropriate governmental entity.

Our point is this: The risk from uranium tailings, even if left uncovered, is de minimis, about the same as driving a car for six blocks. Even this estimate is too high because it is assumes tailings will not be covered, which is contrary to New Mexico law. On the other hand, the risk to workers of denuding 23,000 acres of New Mexico and covering the ponds is very likely to cause far more deaths than even the wildest estimates associated with radon from mill tailings.

To my mind, it is simply wrong to require this huge expenditure of money for such speculative and de minimis risks. It would be much better to spend the money on health research, or to feed the starving multitudes of the world, or to improve our highway system, where some 50,000 Americans per year are killed. This would result in real benefits. It is especially inappropriate to insist that the companies make these huge expenditures on the assumption that the federal and state agencies will simply not do their job of restricting access to the tailings after they are turned over by the companies.

The next EPA proposal relates to limitation of discharges from uranium mill tailings to water to background, that is zero additions to groundwater in terms of concentration. It is important to understand that groundwater is environmentally very different from surface water. Discharges of radionuclides and other elements to groundwater only involve health considerations when the groundwater reaches a place of use. Until it does so the public cannot use it or come in contact with it. Thus, concentrations in groundwater are significant only at the point it will be used. This is important because as the liquid fraction of mill tailings seeps into the ground many of the constituents in it are removed naturally by absorption into the soil and diluted in the groundwater it reaches. This natural process is very important to the mineral industry because the elements that seep from mill tailings towards groundwater are almost entirely the natural elements in the ore itself. These naturally occurring elements were geologically concentrated in commercial uranium deposits in the earth by a very similar process.

The State of New Mexico has made an enormously important contribution to the regulation of discharges to groundwater not only from uranium mills but from many other sources. Our New Mexico Water Quality Control Commission was the first agency in the United States to adopt significant standards for the regulation of discharges to groundwater. When it adopted the groundwater regulations it made a critically important contribution: that is, that the standards for the concentration of constituents in the groundwater were to be measured, not at the place of discharge on the property of the company, but at the place of present or reasonably foreseeable future use of the groundwater by its withdrawal from wells or other devices. It made another great contribution to the intelligent regulation of discharges to groundwater: that is, that the concentrations of elements in groundwater were to be based upon levels that provided protection to the health of humans and animals and plants. New Mexico allows discharge of radionuclides and other elements into groundwater so long as they do not create any health or aesthetic harm.

EPA has taken exactly the opposite approach. First, it measures the concentrations at the foot or toe of the tailings pond, even though these concentrations will naturally be much less at the place of use. This is an enormously expensive regulation, perhaps involving expenditures as much as $500,000,000 in New Mexico alone. Second, EPA's regulations are not based in the slightest upon health considerations. Thus, even though for example, 5 parts per million of uranium in the groundwater may cause no harmful health effects whatsoever, EPA simply will not allow the discharge of any uranium in addition to the background that exist up gradient of the site. This is a philosophical bias on the part of EPA and there is no health justification for such a mode of regulation.

Groundwater in the western United States and New Mexico usually contains a significant amount of mineral in water. In fact, many studies show that in areas where there are significant minerals in the water naturally, both the cancer and heart attack rates are less than in those areas of the country that depend primarily on surface waters for the public water supplies. Studies indicate that the presence of vanadium and selenium in groundwater in small concentrations, improves rather than harms health. Nevertheless, EPA is insisting that uranium milling creates no change at all in the water, even at places it will not be used.

Further, EPA ignores the fact that engineering methods are often used around uranium mills to solve any groundwater problems that exist. These engineered systems are usually installed at places beyond the tailings, often at the company property boundary, and

EPA's regulations simply prohibit such engineering systems. In the one example in New Mexico in which wells used for domestic purposes may have had in the past concentrations that under present regulations would be considered too high for public health purposes, such an engineering system was installed and would have completely eliminated any problem had not EPA objected to it on the philosophical basis that it did not like the processes of dilution.

The New Mexico approach protects the public health completely and does so in a relatively inexpensive method. The EPA approach is enormously expensive and will not result in any health improvement over the New Mexico system. The EPA approach is to enforce a philosophical bias against any change at all, even where it causes no harm, regardless of the cost. Technically, EPA's proposal may not be achievable at all and certainly cannot be achieved in a manner that will allow a viable domestic uranium industry. There is nothing in any act of Congress relating to uranium mining and milling that suggests or requires the imposition of this philosophical bias against any change. Rather, the Uranium Mill Tailings Radiation Control Act is specifically tied to measures that provide health and environmental protection.

Superfund

I would next like to mention EPA's activities at active uranium mills under the Superfund Act. This act was generally to deal with chemical dump sites and provided the funding for cleaning them up. Congress specifically excluded inactive uranium mill sites from the legislation, but EPA is applying the act to active uranium mills. Even if a uranium mill completely complies with all of the health standards of the Nuclear Regulatory Commission, the New Mexico Environmental Improvement Board, and the New Mexico Water Quality Control Commission, that mill can and does wind up on the Superfund list.

This is in part because EPA treats radon releases from mills as very high for scoring purposes even though the radon releases from the mill completely meet all the applicable federal and state regulations and completely protect public health. Oddly enough, if coal-fired electrical generating units releases more radon, as they often do, from the burning of coal, than a uranium mill these sites are not scored at all for radon releases under Superfund. Furthermore, EPA rates some uranium mills high on the scoring list because of releases of constituents to groundwater, where the releases are completely safe for health. Furthermore, EPA scores these groundwater releases high, even though engineering measures reduce the level well below health standards before these releases reach the point of reasonably foreseeable use.

An even greater problem is encountered under the Superfund because EPA applies different standards under Superfund than EPA does for surface water discharges and different standards that the

Nuclear Regulatory Commission, the New Mexico Environmental Improvement Board, and the New Mexico Water Quality Control Commission apply for surface and groundwater discharge. Let me give you an example.

Under the radiation regulations of the NRC and the New Mexico Environmental Improvement Board, water concentrations of uranium for radiation protection are allowed up to approximately 500 parts per million. The New Mexico Water Quality Control Commission has considered the health effects of the chemical properties of uranium and determine that the safe level is 5 parts per million. EPA itself allows 3 to 10 parts per million to be discharged to surface water, which children can drink, from uranium mines and mills. Yet for the Superfund, EPA uses an amazingly low so-called standard for releases to groundwater. This level is approximately 10 pCi/l or about .05 parts per million. This is ten thousand times lower than the level at which the Nuclear Regulatory Commission and the New Mexico Environmental Improvement Board have found safe. This level is simply hopeless to achieve at an existing uranium mill when it is measured at the tailings pond itself.

The situation at active uranium mills created by EPA's actions under Superfund deserves serious consideration by both Congress and the EPA. What EPA is in effect saying is that it will require enormous expenditures at existing uranium mills even though all the air and water releases from these mills meet all of the applicable federal and state regulations. EPA is treating a uranium mill as a chemical dump, even though the tailings themselves are meeting the standards that provide for complete health protection. This is a waste of EPA resources, money and manpower, and not what Congress had in mind when it enacted the Superfund.

Commingled Tailings

The activities of EPA under Superfund at active uranium mills leads naturally to the next subject, which is the status of commingled tailings in New Mexico. By commingled tailings I mean those tailings ponds in New Mexico which contain uranium tailings that were generated in part for the National Defense Program and in part for the commercial market that later developed. At one tailings pond in New Mexico containing some 20,000,000 tons of tailings, more than half were generated for the national defense program. The Comptroller General and Congress have long recognized that the reclamation costs associated with the uranium produced for the national defense program should be paid by the federal government. In the prices paid by the government to the companies for uranium no sums were included for the enormous reclamation costs now proposed by EPA. In 1981 Congress enacted the legislation (P.L. 96-540) which provided for the Department of Energy to conduct a study to determine the method by which the federal government should fund its share of the cost of reclaiming these commingled tailings. The Department of Energy has filed its report, but Congress has not yet taken any action on it.

When the companies point out to EPA that the federal government is responsible for the reclamation cost EPA is insisting on under Superfund, the companies are met with stoney silence. EPA says that

that is the problem of some other branch of the government.

This is a matter that can be easily remedied by Congress at this time. Legislation providing for the Court of Claims to determine the federal government's fair share of the cost of reclaiming tailings generated in part for the national defense program should be adopted to eliminate this impasse that has developed between EPA and the companies.

A subcommittee of the House Armed Services Committee held hearings on commingled tailing approximately one year ago. The virtual unanimous conclusion was that the mill tailings did not pose a health danger in the first place. The subcommittee questioned why should the federal government be expending large sums of money to reclaim those tailings generated for the national defense program if there was no health danger. On the other hand, EPA is proposing to require astronomical expenditures, perhaps more than $1,000,000,000. The companies are the victims in this situation.

Radionuclides Under the Clean Air Act

EPA has also proposed regulations restricting concentrations of radon from uranium mines and mills under provisions of the Clean Air Act. These regulations are not justified by any health consideration. They are oppressive in their restrictions and threatened the viability of any domestic uranium industry. EPA's proposal is to restrict radon concentration at the property line of uranium mines to .2 pCi/l. You may be interested to know that the concentration of radon measured in the cloak room of our national capitol is 4.7 pCi/l. That is 24 times higher as EPA is proposing to allow uranium mines.

There is virtually no one around uranium mines, yet thousands of people pass through our nation's capitol building. For many years, the Atomic Energy Commission, the Nuclear Regulatory Commission, and the New Mexico Environmental Improvement Board have found that concentrations at the property boundary of the company of 3 pCi/l above background adequately protects the public health and safety. The New Mexico uranium mines do not produce concentrations above background higher than this. There is no practical method of technology of reducing the radon emissions from mines to the proposed standard of EPA. EPA has said "Based on available information, EPA has concluded that no practical technology now exists for achieving satisfactory reduction in radon 222 emissions to air from underground uranium mines." In fact, under the existing technology the only way to do this would be to reduce the amount of radon emitted from the mines and thus increase the uranium concentrations underground where the miners work above the federal standards. Such a practice may have the effect of requiring the companies to close the mines.

The proposed EPA standard converts to a working level restriction of approximately .01. Measurements have been made at a solar adobe home in Santa Fe and that working level is about .038, or approximately four times higher than the EPA proposes to allow uranium mines. Tthe total number of people living in the Ambrosia Lake area where the uranium production in New Mexico is concentrated is four, two of which are associated with a restaurant where the burning of natural gas must result in radon concentrations far greater than those proposed by EPA. EPA has recognized that "It is important to recognize that the actual risk to individuals may differ greatly from these estimates because the circumstances involving the exposure may differ significantly from the assumptions used in making the estimates."

To meet EPA's proposed standards in the Ambrosia Lake region, the companies may have to buy up many square miles. Much of this land is owned by the BLM, the Forest Service, the State of New Mexico, various Indian Tribes or Pueblos or individual Indians. As a practical matter, this land cannot be purchased at all.

EPA estimates that a person living about 500 yards from a large uranium mine will be exposed to concentrations of 1 to 2 pCi/l above background. The radon concentration in the Dirksen Tunnel at the U.S. capitol building is about 1 pCi/l; that is, roughly the same as would result from living near a uranium mine. There is simply no health justification for adopting a regulation that may very well eliminate the domestic uranium industry simply to provide a handful of people 5 times more protection than those using the Dirksen Tunnel and 24 times more protection than those at the entry way of the Capitol.

Conclusion

This concludes my statement. If there are any questions, I would be happy to address them.

June 27, 1983

The Honorable William Ruckelshaus
Administrator
U. S. Environmental Protection Agency
401 M. Street, S. W.
Washington, D. C. 20406

Dear Mr. Ruckelshaus:

EPA issued final standards for inactive uranium processing sites at 48 Fed. Reg. 590 (January 5, 1982) and proposed standards for active uranium processing sites at 48 Fed. Reg. 19584 (April 19, 1983). The standards provide for tailings to be stabilized for 200 to 1,000 years, for radon release rates to be limited to 20 pCi/m2-sec. and, in the case of inactive sites, for non-degradation of groundwater and for liners at new facilities or lateral extensions of old facilities.

The 1983 New Mexico Legislature recently adopted Resolutions supporting New Mexico's alternative to the EPA approach. The New Mexico Legislative Radioactive Materials Committee recently adopted a resolution opposing EPA's proposed regulations. We join in these resolutions. New Mexico's alternative provides for stabilization for 200 years, for radon levels to be limited to 3 pCi/liter (or, alternatively .03 WL radon decay products) and for compliance with New Mexico's health-based groundwater standard at points of current or reasonably foreseeable future use.

We support New Mexico's efforts to achieve supportable, cost-effective regulation of mill tailings piles. However, EPA should avoid imposition of unnecessary requirements aimed at relatively trivial hazards. EPA owes a duty to workers not to impose requirements which unnecessarily make their companies uncompetitive and which throw them out of work. We live in an area of high unemployment resulting from the depressed uranium industry, due partially to stiffening regulatory demands. More than 5,500 out of 7,500 are now unemployed. New Mexico's alternatives are adequate to protect the public health and safety and the environment and are practical to implement. We urge EPA not to adopt contrary regulations. We ask you to take this expression of the people of New Mexico's views into complete account.

Very truly yours,

[Note: This letter, submitted by the New Mexico Mining Association, represents 195 others sent to the Administrator of the Environmental Protection Agency.]

TESTIMONY PRESENTED TO THE SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

July 6, 1983

Jay B. Sorenson
Sierra Club

Albuquerque
New Mexico

I am Jay B. Sorenson, a representative of the Sierra Club. I am the former chairperson of the EPA/Albuquerque Citizen Advisory Committee on the irradiated treatment of sludge. I have been a member of the state's Water Quality Control Commission, and a member of the Department of Interior's Task Force on uranium mining and milling in the San Juan Regional Basin. I am presently heading up a small Working Group of scientists to review the state's radiation regulations for the Governor. I am also a member of the American Lung Society of New Mexico's Air Quality Committee.

I am a University of New Mexico Professor of Political Science, teach courses on the environment, and have written on the acceptability of risks. In this regard, I have helped to design an environment, safety, and health assurance standard for DOE and its contractors. It is being field tested, and has, so far, contributed to a 1/3 drop in the occupational accident and injury rates. It is being applied by a number of major national firms as well. I will say more about this assurance standard later.

On behalf of the environmental community, I should like to express our appreciation to the two of you for this hearing in New Mexico. We know that we have to win your support, and I hope that these remarks, along with Secretary MacNeill's, John Bartlett's, and Paul Robinson's, will convince you of the wisdom of our position, and the need for rigorous protection of the environment and public health, nationally and in New Mexico.

Major Concerns: Protect an Environment Under Increasing Stress

We have major environment, safety, and health concerns in New Mexico that are related to EPA's mission.

New Mexico is more fortunate than most states, for it is still in the relatively early stages of industrial development. This means, if we act with determination now, there is still time to prevent much pollution and to protect an environment of superior quality -- far better than in other parts of the nation.

Quality of Environment Index

To convey our concern, let me offer a gross evaluation of our environmental quality.

It is largely based on a Quality of Environment Index designed by the National Wildlife Federation. It presents an evaluation of environmental quality by comparing today with that of a decade ago on a simple scale of the "same," "better," or "worse." It also offers insights into the problems of the future.

The results I am presenting do represent the observations of some of the state's environmental managers, lay people, and concerned citizens, and it reflects work, I and two others, have just completed for the state's Secretary of Health and Environment. Since others have dealt with our environmental concerns, I will discuss water, my area of interest, more than air, land, etc.

With regard to the evaluations, the findings indicate that:

Air. Progress continues, but on the index the overall perception of air quality is not as good as it used to be. Notable headway is seen to be evident where pollution controls are introduced. This is particularly so in the Northwest quadrant of the state, where pollution controls on electrical generating plants have contributed to a marked improvement in air quality for areas extending to the Rio Grande Basin.

In contrast, the air quality around our urban areas is seen to be deteriorating. It reflects sunbelt migration and economic development. We also have air quality problems associated with our mining and oil and gas industries. For example,

- the impact of nitric oxide (NO) point source on the nitrogen dioxide (NO_2) standard in southeastern New Mexico.
- radon (and daughters) from mine vents in the uranium belt is not regulated.
- EPA's inhalable particulate (IP) matter standard for health and welfare is needed for the state to develop its own reguations and monitoring program.

Fortunately we may be free of acid rain problems, but the effect on our forests is still unclear.

Land. The evaluation registers worse on the index. Economic growth, which we badly need, is what is placing the greatest stress on this resource. So too is the demand for living space, mineral and oil and gas extraction, farmland and forest losses. With regard to wetlands and wildlife habitat protection, our situation looks as if it will confirm the gloomy EPA assessments of staggering losses of wildlife habitat to the year 2000.

Water. On the environmental quality scale, at best we appear to be holding our own with regard to surface water, and worse with regard to ground water quality.

In many respects, our problem is not any different than it is for the rest of the nation. We face a shortage, less because of scarcity, than because of man-made contamination and poor institutional management. In short, water, a renewable resource, is being managed in such a way that it is not possible to protect its quality and to recyle it as efficiently we could for additional uses. In this way, we are turning it into a much more limited resource than it need be. In this way, we, like the rest of the nation, can face a water crisis in the 1980s that will surpass the energy crisis of the 1970s.

While it is true much of the water quality problem relates to old sources, and that we have been able to gain control of many new sources -- it is also true we have problems with new sources. An outstanding one is the thorium contamination as a result of the uranium mill tailings spill at Churchrock. Significantly, we are beginning to find problems that we did not suspect. Organic toxics and hydrocarbons are particularly troublesome in this regard.

Hazardous waste disposal and ground water protection is a growing problem in New Mexico, even if it is not as formidable as in New York, New Jersey, California and other states. Since most people in New Mexico are dependent on ground water, we cannot afford contamination due to unpretreated industrial wastes, poor hazardous waste disposal, or direct discharges in violation of NPDES permits that EPA considers too insignficant to prohbit by enforcement measures.

A major problem that EPA has contributed to is its ap-

> proval of the state's "reasonable degradation" clause in its ground water regulations. Since the concept of "reasonable degradation" flies in the face of the basic provisions of the Clean Water Act, it is hard to see how the Dallas Office of EPA could have approved it.
>
> Justification of it in terms of the Western doctrine of "benefical use" is not persuasive, since the Western doctrine is premised on the maximum use of water at the cost of water quality: the water that is not consumed carries an increased load of salts and other contaminants.
>
> The clash between the City of Grants and the downstream pueblos of Acoma and Laguna over Grants' wastewater contaminating the pueblos' water probably heralds the future. Even if Grants were in full compliance, its discharges would contribute to a lower quality of water for downstream users. Grants, with the support of members of the Water Quality Control Commission, justifies it on the grounds that the state regulations allow "reasonable degradation." Will this be the problem for all downstream users?
>
> Some day it could mean we will not be able to recycle and conserve our supply effectively because the state could not wean itself from an antiquated doctrine of Western water law, and EPA lacked the courage to enforce the federal law.
>
> This is the quintessence of poor institutional water management. It sorely needs to be corrected.

This crude overview tells the story of a resource under stress. We have controls, but we are barely holding our own. The haunting question is where, in the near forseeable future, will we be when the environment will be under even greater stress?

In other words, to prevent further erosion of our position, our stress in many areas like ground water, needs to be on prevention, not "clean up" efforts "after the fact."

Clearly, this is going to turn on our ability to maintain a close partnership with an EPA committed to rigorous protection.

We have an agenda, with regard to water we take heart in the unanimous vote of the Senate Environment and Public Works Committee last week approving a comprehensive clean water bill without major changes. We believe that the necessary pragmatic changes have occurred:

- the extension of deadlines from five to ten years as the maximum life of industrial discharge permits, and
- measures giving industry until three extra years, or until the summer of 1987, to comply with specific anti-pollution standards.

On nonpoint pollution -- which we gather will be treated as a separate issue -- we should like to point out that nonpoint sources cause the most serious form of water pollution in New Mexico. It is largely caused by agriculture, by overgrazing and soil erosion, with heavy sediment loading of our rivers and streams. We would urge that the Senate and EPA not allow slippage in the effort to control this very controversial source of water contamination.

We have read in the Wall Street Journal, and elsewhere, that industry groups are stepping up lobbying efforts to ease the language of the Bill, especially in the area of toxic waste controls. It is our hope that the two of you will use your good offices to urge the Administration to accept the wisdom of the Senate committee, and cease to amend the Act, particularly with regard to the provisions for pretreatment, toxics, protection of wetlands, etc. We urge its passage as one of the principal vehicles that has made it possible to gain on surface water pollution over the 1970s.

The Bottom Line Issue: Risk Assessment or Assurance?

I could inventory New Mexico's environment, safety, and health problems in considerable detail, but I should like to turn to the fundamental issue underlying all of our concerns:

the determination of acceptable levels of risk.

The importance of this question cannot be exaggerated, for, at heart, it is the vital question of: "Who lives?", "Who dies?", and "Who decides?"

I should like to address the issue within the context of Mr. Ruckelshaus' recent speech, called by the Wall Street Journal, "his first major policy speech since taking office four weeks ago." (At the time of the writing of this testimony, a transcript of his speech was not available. Senator Domenici's staff, however, graciously hand carried a copy to Albuquerque on Tuesday.)

Mr.Ruckelshaus, you are observed to have said the "government needs to allay the public's fears" posed by toxic pollutants, and to have made a "strong plea for a unified approach" between the federal government and scientists "to assessing dangers of cancer-causing chemicals" so as to "better protect the public." Quoted as stating that "many communities are gripped by something approaching panic" over toxic environmental hazards, you are also reported to have stressed the revitalized partnership to "rescue" the nation from its current "paralysis" in dealing with its acceptance of the toxic risks.

We basically agree, and we appreciate a number of points:

No health Downplay

- unlike other administration officials, there appears to be no attempt to downplay public health risks in the name of easing environmental deadlines and restrictions.

Public Participation

- your reported stress on the importance of public participation in the evaluation of risk, we view as very important.

We hope you plan to put the teeth back into the entire process that Mrs. Burford partially succeeded in pulling.

As a former chairperson of an EPA citizen advisory committee on a very controversial project in our community - the irradiated treatment of sludge - I can assure you the public participation process not only works, but is essential for confidence and consensus building. In this regard, we also agree that,

Political Motives

- many of EPA's current problems stem from a feeling among the public that political considerations and other policy objectives have been used to judge possible health risks. We concur that "nothing will erode public confidence faster than the suspicion" that political motives influenced scientific determinations.

We welcome all of these statements.

We, however, are disturbed by two reported suggestions;

Single Framework

1) your reported echoing of the theme of a single framework for risk assessment by all federal

agencies -- on the grounds that "the public interest isn't served" by agencies taking "diametrically opposed positions" on health risks.

We understand your reasoning, but we are not convinced the public is not well served by controversy between different issues on environmental health risk issues.

We are reminded, for example, of the long standing battle between the old Atomic Energy Commission (AEC) and the Public Health Service over the health effects of radiation.

The conflict contributed substantially to the knowledge we possess today, and to the lowering of the exposure levels we now consider to be permissable.

We wonder whether, without this conflict, the AEC would have initated a review of its strongly held assessment?

Adequate Safety Margin

2) More troublesome is your quoted statement that it is "difficult if not impossible" to establish "an adequate margin of safety" for some cancer risks.

Alone this is not disturbing, but it appears to be coupled with the strong suggestion that a cost-benefit analysis would be a better way to establish risk acceptability.

We hope this is not the case. We are familiar with cost-benefit analysis, as we are with basing standards on natural background, expressed preferences and revealed preferences, etc.

We do not believe any one of these methods provides a clear criteria or can serve all of our varied needs in risk determinations - legal, social, health, costs, equity, etc.

We do take strong exception, however, to any stress on cost-benefit analysis as the preferred means to establish risk acceptability in cases, like that of toxic risk, where the fundamental issue is a health concern.

Involuntary Risk

We do so for the following reasons: a) we see environmental health risks to be involuntary risks. They are imposed on people, and they are nonexcludable -- there is no choice. And, b) they cannot be controlled by the people at-risk, but require government intervention and regulation for protection.

What is at stake is an additional lifetime health risk. Since it is usually a consequence of man-made activities, it is a risk over and above a natural exposure, and thereby constitutes excess and "unnatural" expesure. This is particularly the case for toxic risk, often caused by new compounds unknown in nature and for which there is no historical tolerance, and for many radiation risks.

Under these conditions, we consider it singularly inappropriate to substitute economic considerations as the standard for public health determinations. We are reminded of Justice William Brennan's decision in the cotton dust case that the health of workers outweighs "all other considerations" and that "Any standard based on a balancing of costs and benefits... would be inconsistent with the law."

If the decision refers to OSHA, the court also unanimously held that EPA need not concern itself with the economic impact of compliance with water pollution laws in the crushed stone case.

Our point is simple. In health cases, cost considerations take second place to health protection!

It is for these reasons that we believe an "adequate margin of safety" criteria, with all its attendant problems, is the better standard.

It, at least, uses health measures, often based in New Mexico on a safety level of two times observed adverse effects. Not a bad way to ensure protection.

De Minimis Risk

If an alternative is to be sought, however, we should like to call your attention to de minimis risk as the standard that might be employed. It essentially means quantities of man-made toxic materials in the environment so minute as to be considered relatively harmless to man and his environment.

Since none of the analytical methods mentioned above (cost-benefit, natural standards, expressed and revealdd preferences) are able to provide the quantitative and qualitative information required for effects from small exposures for long term periods, and since there will always be exposure to potentially harmful chemicals and chemicals in involuntary ways -- a de minimis standard that holds environmental health risks low has much to be said for it.

Zero-Risk

If both (adequate margins of safety and de minimis risk) are linked, what is obtained is a way to deal with the zero-risk/environmental health protection problem. Since it is clear that there is no such thing as zero-risk, and that we cannot legislate

> realistically for it; and since we need the products associated with many hazardous materials -- the concept of de minimis risk offers a promising approach to solving the intractable problem of "acceptable risk."

These are some of our thoughts, but they all tie into one very basic point.

The Need for Assurance and a Model

What we really need is not a process that stresses risk assessment, but one that stresses the assurance of the acceptability of the risks.

This is the bottom line.

To solve the problem of a crisis of confidence over risk taking in our society, we must be able to assure the public that the involuntary environmental health risks they are asked to bear are "reasonable"--- as tested by prudent, average people -- and that they are based on levels of protection prudent people would judge to be low and acceptable.

In many respects, this is the very basis of the environment, safety, and health assurance standard developed and field tested for the Department of Energy and its contractors.

In its elemental form, it is based on the requirements that:

- All significant hazards be identified,
- Adequate approaches to their control must be known,
- Such controls must be acceptable to those at-risk and implemented,

- Change in factors that would increase danger must be controlled,
- Emergencies must be prepared for in tested, reliable ways, and
- Independently verified evidence of these first five requirements must exist.

It is a concept geared to provide not only control of hazards, but to overcome confidence problems by pegging risk standards to the acceptance of those at-risk (by means of public participation, legislation, collective bargaining, etc.), and ensuring their involvement in the process.

Unlike other approaches, it does not posit the wisdom of determining risk acceptance in a scientific technocracy or in governmental officials alone.

It also requires positive verification that the controls designed to afford protection at acceptable levels of risk are in fact being used.

If this process is linked to the idea that environmental risk should be kept at minimal levels, a credible tool exists to overcome the crisis of confidence that, in Mr. Ruckelshaus's words, is "paralyzing the country," and that is necessary to rebuild a consensus on risk taking in our society.

We believe it can prove as effective in the regulatory area of environmental protection as it is proving in the area of occupational protection.

We offer it as a constructive proposal to help solve a problem all of us need solved in a mutually acceptable way.

We have a real opportunity to work for a joint solution to our environmental problems.

We hope EPA and you, Senator Domenici, see the wisdom of our concerns and proposals, and make it possible for all of us to solve our environmental problems in a cooperative way.

ADDITIONAL REMARKS

By

Jay B. Sorenson

As noted in my testimony, I received S.431 late the day before the hearing (despite all the good efforts of Linda Findlay), and hence could not be as specific with regard to comments on the proposed changes to the Clean Water Act.

My supplemental comments follow. They should be taken in the context of a larger observation. The Clean Water Act has been a mixed success. While some headway has been made containing surface and ground water pollution in a period of substantial industrial growth, water quality has not greatly improved over the past decade. Even where water is plentiful, it is polluted; and where it is in short supply, long term pollution trend lines are troublesome. In revising the Act, the Senate should not retreat from the original goal -- attaing clean water by the mid-1980s.

While it is important to maintain the integrity of the Clean Water Act, and to strengthen many of its provisions, one real problem in making headway lies less with the provisions of the Act than in the long delay in implementing the Law. As matters now stand, the benefits go to the polluters who discharge into municipal sewer systems and to those who dump directly into water ways rather than to those who strive to comply with the law. The curtailment of federal funds and a weakened EPA lie at the heart of the implementation and reversed rewards problem. Measures to correct the funding deficiency and to strengthen EPA's will to protect the environment should be high on the Senate's agenda.

Within these larger observations, the following specific points need to be made:

(1) Pretreatment "Opt-out." This option, as the Senate Committee wisely concluded, should not be allowed. Senator Chafee's lead should be strongly supported. Any effort led by Senator Symms to secure a floor amendment should be resoultely resisted. The core of the problem remains the inability on the part of many local officals to acquire the independence and technical expertise to make a local "opt-out" work.

(2) Toxic "Hot-Spots." This provision requiring states to identify "toxic hot-spots," where additional controls on the discharge of toxics by industry is needed, is sound, and should be supported.

(3) State Water Quality Standards. We support the effort to codify water quality standards. It is essential to prevent the weakening of state water quality standards, as EPA under its former Administrator has proposed. Many states, if not prodded by the federal government, will, as in the past, allow state standards to take second place to economic growth.

(4) Sewage Treatment Wavers. The introduction of additional requirements that have to be met before waivers can be granted to sewage treatment plants discharging into estuaries and oceans is very sound and should be defended in its entirety. This is also the case for no waivers for discharges into polluted estuaries.

(5) Compliance Dates/BAT. The three year extension date is longer than we believe is necessary, and although we are concerned, we see it as a pragmatic decision, and take heart in the fact that the requirements for re-opening permits are stronger than in the current statute.

(6) Nonpoint Pollution. Nonpoint pollution, as noted in my testimony, is the most serious form of water pollution in New Mexico. Agriculture is the main culprit. While runoff from city streets and construction contributes to our contamination problem, overgrazing is the single largest activity contributing to soil erosion and heavy sediment loading of our surface waters.

This source of pollution is now largely uncontrolled. It is critical that the provisions requiring the introduction of Best Management Practices have teeth. Unless this is done, states will do as New Mexico has done -- declare existing management practices to be best management practices, and generally ignore the problem.

In short, we support Senators Durenberger and Chaffee in the effort to require states to identify bodies of water polluted by agriculture and urban runoff, and require polluters to implement Best Management Practices to control nonpoint pollution within four years.

Under no conditions should the nonpoint pollution provisions be simply a grants program to the states. We also favor a stronger role for the federal government, should the states continue to fail to make real headway with nonpoint pollution.

(7) Wetlands. To protect the scarce, vulnerable wetlands, we believe two things are essential: (i) EPA should be assigned a major role in protecting wetlands, and (ii) the numerous changes proposed by the Army Corps of Engineers governing dredge-and-fill activities should be rejected. The Army Corps should also be required to prove no practicable alternative and no unacceptable adverse effects as a requirement for its 403 dredging permits.

(8) Dams. Discharges from large dams can cause water degradation problems for downstream water users, and it can result in significant fish kill. We favor additional study and monitoring of these effects. As important, we favor provisions requiring the states to pursue practicable masures presently available to control this problem. Right now the states largely deal with this problem by sweeping it under the rug. Unless required to do something by the federal government, the water pollution problems created by dams will be largely ignored, and this the nation, facing critical water supply and quality problems, simply cannot afford this.

These supplemental remarks conclude my testimony. We hope they are useful to you in your deliberations on the reauthorization of the Clean Water Act, and we hope they are useful to Mr. Ruckelshaus in his effort to redirect EPA, and to secure the best protection he can for an environment under stress.

The importance of these observations is underscored by one salient point. The demand for water will outpace supply, and its quality will be under greater threat of degradation in the future than it is today. Just to hold our own, we will need all the statutory and regulatory tools we can secure. The Clean Water Act is one of the principal tools, and we need to keep it as viable as ever.

Statement By
Harry L. Storey, Chairman
Clean Air ad hoc Committee of the Western Regional Council
Before The
Senate Committee on Environment and Public Works
Albuquerque, New Mexico
July 6, 1983

I am Harry L. Storey, Director of Industry and Legislative Issues for Anaconda Minerals, a subsidiary of the Atlantic Richfield Company. I appear before you today on behalf of the Western Regional Council and as the Chairman of the WRC's Clean Air ad hoc Committee.

The Western Regional Council is a coalition of 47 major companies active in the eight Rocky Mountain states. Our membership includes businesses engaged in financial, energy, mining, transportation, manufacturing and other enterprises. Several member companies are active or based in New Mexico.

The purpose of the WRC is to provide a forum for the resolution of issues which uniquely affect the business community in our region and to recommend policies to State and Federal governments which recognize the need for both a healthy economy and a healthy environment in which to live.

We in the WRC appreciate the opportunity to participate in this hearing. We thank Senator Domenici for scheduling it and we appreciate Administrator Ruckelshaus' coming to New Mexico to hear westerners talk about western issues within the domain of the Environmental Protection Agency.

The Western Regional Council has been particularly active in two issue areas under the purview of the EPA, clean air and clean water. We have worked aggressively over the years, both with the Congress and the Administration, on those clean air and clean water issues we believe uniquely impact on the West.

I will first share with you our concerns and issues in regard to the Clean Air Act and then move to the Clean Water Act.

CLEAN AIR ACT

The WRC supports legislative efforts to reauthorize the Clean Air Act and is hopeful for action yet this Congress. We are hopeful, too, that the new EPA Administrator will be an active, positive and encouraging force toward that end.

As business people who live and work in the West, we in the WRC support the Clean Air Act's goals and intent and what it can mean for the Western quality of life. We therefore advocate stringent protection of our pristine areas, the National Parks and the Wilderness areas, and we do not seek changes in the Act which we feel would contribute to overall deterioration of air quality in our States. We are concerned, though, too, with specific provisions of the Act and with current legislative proposals which we believe go beyond prudent efforts to improve air quality, cause unnecessary adverse economic impacts, and in some cases, abuse the intent of the Clean Air Act to accomplish other purposes.

Let me briefly review our positions.

PREVENTION OF SIGNIFICANT DETERIORATION

Under Prevention of Significant Deterioration, the WRC recommends the retention of the most stringent PSD requirements, those for Class I areas, but we believe that the short term increments should be eliminated. We recommend dropping Class II and III designations, but retention of BACT as an integral part of the PSD program, to assure that new sources will utilize the best pollution control equipment available for each pollutant.

VISIBILITY

The visibility issue is a very important one to the WRC and has its greatest impact in the West. We oppose the integral vista concept. It is not a part of the Act and it would extend Federal jurisdiction far outside the boundaries of Class I areas frustrating state, local, and private land use and siting decision-making roles. We believe the language adopted by the Senate Committee last year would create an unworkable situation in which the State would find itself with an impossible burden of proof in determining an overriding public interest in siting a facility. We strongly support attempts to remove this language and hope to work with the Administration toward finding more workable approaches on the visibility issue.

FUGITIVE DUST

On fugitive dust, we agree with the attempt by the Committee to provide an exemption for large, non-respirable, non-toxic particulate, but would hope the Committee this year could better clarify in legislative language the phrase "uncontaminated soils." Potential problems involving dust from haul roads and mining related activites prompted our work for a fugitive dust exemption. Language currently in the bill might preclude its application to those activities.

PERCENTAGE REDUCTION

We are opposed to the percentage reduction requirement under NSPS. We realize the difficulty this issue has caused for the Senate Committee, and we are grateful for the efforts of Senator Domenici with Senator Simpson to change the provision. We continue to believe that sources should be allowed to meet emission limits through the most cost-effective means available. To force costly scrubbing when less expensive methods of emission reductions are available, subverts the purposes of the Act to regional economic protectionism. We realize that Western Governors do not want to lose advances made in the West in reducing emissions resulting from percentage reduction. However, we would urge the Congress to eliminate the percentage reduction requirement and debate the real issue of emission levels.

NONFERROUS SMELTERS

The WRC supports the Domenici amendment included in the Senate Committee bill, S. 768, to Section 117 of the Act to provide continued flexibility for nonferrous smelters to use supplementary control systems under limited conditions and for the issuance of nonferrous smelter orders to 1993. The nation's domestic copper industry is in serious financial jeopardy. If this provision is not included, the Southwest in particular will have massive layoffs and our nation will become dependent upon foreign sources for its copper.

INTERSTATE POLLUTION

The WRC opposes the interstate pollution amendments now contained in the Senate Committee bill. The proposed amendments would transform the current narrow, precisely defined system of appeal, with the EPA Administrator acting as a mediator, into one that is extremely open-ended. The amendment would permit any citizen, instead of one state pursuing another state, to take action against any alleged source or group of sources on interstate pollution through the Federal District Court. The amendment would enable such action against almost any level or kind of pollution, notwithstanding existing concepts of specified air quality standards or criteria pollutants. These amendments, if left intact, could conceivably shift to the courts a parallel system of air pollution control taking from the Congress and the EPA their appropriate responsibilities.

ACID RAIN

The Western Regional Council has for some time had a position on the issue of acid rain. New information and new legislative proposals are moving quickly on this issue and we are reviewing our position in light of those developments. Our new acid rain position is not yet finalized by our organization, but I do want to share with you our basic concerns.

First, I want to point out that we recognize the level of public interest in the acid rain issue and the strong commitment several Members of Congress have made to adopt acid rain control legislation. While the problem deserves careful attention, it would be unfortunate if it were to deprive other important clean air issues of the thorough consideration they also deserve.

Although there remain many fundamental questions surrounding the causes and effects of acid precipitation, scientific reports have been released in the past few weeks which are more conclusive about the nature of acid rain and the relationship between it and emissions. Those reports also reinforce the regional nature of the problem as now understood.

To date, research in the Western States has been much more modest than that in the East, but it has not identified serious acid precipitation problems such as exist in the Northeast. A number of factors may account for that difference. There are fewer coal-fired power plants in the West and they are widely dispersed. Furthermore, they are subject to stringent emission limitations and use low sulfur coal. Less than one tenth of the sulfur dioxide emissions produced by coal fired plants in the U.S. is generated in the West. In the West we have a drier climate allowing less acid formation in the atmosphere. Also, much of the West has a typically alkaline soil which provides natural buffering capacity with respect to acidic reactions.

We in the WRC believe that if Congress legislates to improve controls to reduce acid precipitation, that regional variations and state flexibility be taken into account. Initial emission controls should be applied to mobile and stationary sources in regions where significant acid precipitation problems exist. We will continue to advocate accelerated research to better understand the phenomenon and believe that emission reduction requirements should be implemented in a program of several phases as more is understood. Research results should be the basis upon which control measures are designed.

Overall costs of reductions in emissions to reduce acid precipitation are estimated in the billions of dollars. To the extent that controls are phased corresponding to research results and to the extent that sources are permitted flexibility in achieving reductions, the costs can be minimized. Major initial reductions in sulfur dioxide emissions from coal fired power plants can be achieved though coal washing, fuel blending, and switching to low sulfur fuels, without the installation of technological controls, controls which are expensive to install and just as costly to operate. Sources should be provided the flexibility to decide how best they can meet emission limitations at the lowest possible cost.

We will oppose efforts to spread the costs of emission reductions. Coal fired power plants in the West have already been required to install technological controls at enormous expense. These controls were imposed despite the relatively lower emission levels in the region due to use of low sulfur fuels. These costs were and continue to be born by the utilities and their customers, as those costs are likewise born by sources in other regions which have been required to reduce emissions. We see no equity in proposals to spread the costs of emission reductions beyond the individual source. Furthermore, we in the West must question the idea of our helping to pay the costs of installation of technological controls. Part of the rationale for requiring technological controls is not because of their efficiency in reducing emissions, but because of their promise of shoring up the high sulfur coal industry. How can we in the West, with our abundant low sulfur fuel reserves, be asked to share the costs of measures that will preclude markets for our resources? We oppose a regional or national fee or tax on utilities, consumers, fuel, or other proposals that would shift the financial burden from the pollutor.

Various legislative proposals to address the problem of acid rain include a cap on emission levels. Several factors other than control measures will influence the levels of emissions at any one time. Levels of consumption of electricity will fluctuate with weather conditions, fuel costs, conservation practices and other factors. Plant operations themselves and specific industry circumstances can dramatically influence the emission levels for any one year or time. We believe it is important to recognize these variables in discussing a cap on emissions. No one year will necessarily be satisfactory to every sector. We therefore suggest that if a cap on emissions is included in legislation, that it should reflect the allowable emission levels at the time of enactment.

CLEAN WATER ACT

Another issue on which the Western Regional Council has been working for the last two years is amendment of the Clean Water Act. The Council has testified before the Senate Subcommittee on Environmental Pollution and has worked closely with subcommittee staff on specific amendments to the Act.

Water is a critical commodity in the West; therefore, quantitative and qualitative water management is of significant importance to the Western Regional Council. Although the Council supports the basic concepts of the Clean Water Act, the Council asserts that a nationwide "across the board" application of the Act results in certain provisions having a significant adverse impact on the West due to the unique features of western water. The intent of the Council's recommendations is therefore not to change the basic concepts of the Act, but to provide the flexibility in implementation which is required for sound water management in the West. I would like to address five areas of the Act which, in the WRC's opinion, are in need of amendment. Attached to our statement are specific amendment language which we have proposed on these areas.

POINT SOURCE DEFINITION

One of the chief purposes of the Clean Water Act is to regulate the discharge of harmful pollutants from industrial processes. However, the Act only regulates discharges from "point sources," which are generally defined as "discrete conveyances" such as pipes (Sec. 502(14)). The Act does not, for example, authorize EPA to regulate diffuse storm runoff or snowmelt running across an industrial facility. However, EPA has interpreted the term "point source" to include devices which gather, collect or otherwise divert stormwater runoff or snowmelt. As a consequence, those mining and other industrial facilities that otherwise have no obligation to treat diffuse stormwater runoff or snowmelt, but have constructed diversion structures to prevent their contact with process areas and toxic materials, are often required to obtain an NPDES permit requiring them to treat these waters.

In the West the amounts of stormwater runoff and snowmelt in mountainous areas surrounding industrial facilities are very large and the treatment cost is often prohibitive. Much of this stormwater runoff is not toxic and to require its treatment when not contaminated by the industry seems punitive.

The WRC recommends that devices that merely divert or gather and collect storm runoff and snowmelt without adding to their contamination should not be considered "point source" subject to EPA regulation. Including such devices in the definition of "point source" penalizes many companies for installing devices that serve to prevent or minimize pollution and were not required to be installed. The Senate Committee on Environment and Public Works has included in its version of the bill an amendment to redefine stormwater runoff which will alleviate the WRC's concerns.

ZERO DISCHARGE GOAL

It is the goal of the Act that the discharge of pollutants into navigable waters be eliminated by 1983 (also known as zero discharge goal). The legislative history reveals that Congress never intended the zero discharge goal to be legally binding, but only a "target". The term pollutant is broadly defined under the act to include all waste regardless of quality (Section 502(6)). Therefore, regulatory bodies are interpreting the goal literally to mean that all discharges, including the return of reclaimed water from industrial and agricultural use, must be eliminated by 1985 regardless of quality. Thus, the "zero discharge" concept is moving the implementing sections and programs in the Act toward elimination of all discharges.

In the Intermountain West, water basin compacts and surface water adjudications have been based on historical flows which include return flows after upstream water use. Also, many of the water users on such rivers as the Colorado are anticipating return flow credit in order to fulfill future water needs. However, as a result of the zero discharge goal, as interpreted by state and federal agencies, states are being compelled to abandon water rights. Relative to water quality concerns, states are again compelled to encourage consumptive use regardless of the fact that water quality impact from returned waters would be negligible. This effectively results in the compromising of the policy in Section 101(g) to protect a state's right to allocate water quantities within its boundaries and manage its water based on both quantity and quality considerations.

In the intermountain West where many surface streams can reach zero flows during periods of the year, downstream water availability relies heavily on the return of water to the surface stream. For example, Arizona, in its Water Pollution Control Act, requires the regulatory agency, in adopting regulations concerning discharges, to "... be guided by the principle that waters of the State are put to beneficial use within the State and become return flows to the waters of the State and subsequently reused, and that such rules and regulations shall not diminish the water available for such beneficial uses, nor deprive the State of such water." (A.R.S. Section 36-1854 B). EPA Region 9 has refused to grant primary enforcement authority to the State of Arizona under the NPDES program. A major stumbling block in this delegation of authority has been this legislative policy which Region 9 believes conflicts with the zero discharge goal. If the zero discharge goal is interpreted literally, it will be inconsistent with water preservation and water rights doctrine in the arid West.

The Clean Water Act's Section 101(g) states that this Act shall not supersede or abrogate state water rights. The WRC recommends strengthening this provision so that the Clean Water Act would no longer be in conflict with western states water law. The WRC is pleased that the Senate Committee has agreed to include legislative history in its report which will clarify the situation and should result in a strengthened Section 101(g).

WATER QUALITY STANDARDS

Dischargers required to install treatment technology that is "better" than BAT should be given the opportunity to show that advanced treatment is economically unreasonable. Current federal law does not ensure that dischargers have this opportunity--in fact, past EPA policy seems to have discouraged it.

Since the availability of such review has been a matter of recent confusion, it will be useful to review the current statutory scheme:

1. Section 303(c) requires states to adopt water quality standards. These standards must be approved by EPA if they "meet the requirements" of the Act. In applying this vague standard, EPA does not require states to evaluate

the economic reasonableness of their rules. Whether they do so is a matter of state law.

2. Upon the adoption of water quality standards, Section 301(b)(1)(C) requires dischargers to attain whatever effluent limitations are necessary to protect the standards, even if such limitations are more stringent than BAT. This requirement is absolute; the discharger cannot challenge its "reasonableness." Nor are the dischargers given the right to reopen the question of the propriety of the standards.

3. Section 302 authorizes EPA to impose effluent limitations more stringent than BAT if necessary to protect "water supplies, agricultural and industrial uses, ... recreational activities ...." However, before the limitations can be imposed, EPA must hold a hearing to consider the economic and social impacts.

On first reading, this section would seem to require that economic factors be considered before any "water quality related effluent limitations" can be imposed on a discharger. However, this is not the case, because Section 302 applies only to EPA, and not to the states. Therefore, EPA has managed to avoid the burdens of Section 302 through the use of a simple alternative; if the agency decides that uses described in Section 302 are receiving inadequate protection, all it need do is allege that water quality standards no longer "meet the requirements of the Act," and call for a revision of these standards pursuant to Section 303. This throws the burden back on the states, and if they fail to adopt more stringent standards, EPA can do it for them, citing the "fishable swimmable" goals of the Act and ignoring Section 302.

As a result of such tactics, many stream segments now carry "designated uses" that have never been attained in fact. Other stream segments carry use designations that have been "attained" on a short-term basis, but which cannot be reasonably maintained over the long term. Under Senator Chafee's original bill, S. 431, these streams could never be redesignated, no matter how reasonable redesignation might be. The WRC sympathizes with Senator Chafee's goals. However, an across-the-board prohibition of "downgrading" seems unreasonable, for at least two reasons:

1. Many use designations are not health related--they relate solely to "welfare." Yet, under the bill, protection of these uses would automatically be elevated over all other considerations.

2. The bill seems to penalize people who have done the most to comply with the Act. As noted above, many companies have made considerable effort to clean up

streams through the use of innovative and expensive technology. However, it is unclear if short-term uses added by these efforts can always be maintained over the long term. For instance:

As the Senate Subcommittee on Environmental Pollution marked-up its amendments to the Act, the WRC was happy to see that Section 302(a) of the Clean Water Act had been amended by inserting after "in the judgment of the Administrator" the phrase "or the State, or as identified under Section 305(c)." This amendment has now been deleted. As reported to the WRC, this amendment was deleted at the request of the Environmental Protection Agency. The WRC has met twice with EPA staff in the past year to discuss our amendments to the Clean Water Act. We have been disappointed that EPA has not been able to assist the WRC in its attempt to amend the Clean Water Act nor to present alternatives to solve the West's problems with the Act. Since the EPA and the Senate Committee on Environment and Public Works are still working on the water quality standards section of the Senate bill, the WRC would like to request the EPA give consideration to the WRC's proposal regarding water quality standards.

The WRC would also like to briefly mention two amendments to the Clean Water Act which deal with Section 404 of the Act. Although the Senate has refused to deal with this section of the Act in conjunction with the reauthorization of the Clean Water Act, the WRC continues to work for its amendments.

NAVIGABLE WATER DEFINITION

EPA's jurisdiction for regulation of water discharges under the Clean Water Act is confined to "navigable waters". The Agency, pursuant to court decisions, has defined the term "navigable waters" broadly so as to include streambeds that: (1) have water in them only occasionally as a result of rains or snowmelt; (2) do not support fish, shellfish or wildlife; (3) do not provide water to downstream users; and (4) do not flow into other streams, rivers, or lakes.

As a consequence of EPA's broad definition of the term "navigable waters", sources that discharge into such streambeds are threatened with large capital and operating expense to meet the Agency's effluent limitations regulations, even though the discharges do not harm surface waters nor adversely affect water quality in other water bodies.

Unique features of Western waters need to be considered. The definition of navigable waters at Section 502(7) is so broad that it encompasses nearly every water course in the United States, including normally dry arroyos in the West. Because of this broad definition, the prohibition at Section 301 of the discharge of pollutants into waters of the United States without a permit, applies to many streams which may not need this level of protection. In the arid western United States there are streams which flow intermittently as a result of rain runoff or snowmelt and when they do flow, do not empty into public bodies of water which need protection, do not support fish or wildlife and do not provide water for downstream users.

For instance, some industrial discharges are into streams which empty into desert playas which are in fact sealed basins where the water eventually evaporates. Most desert playas contain considerable naturally occurring salts and their waters are not used. Therefore, to require treatment of discharges into these playas is to require treatment for treatment's sake, since no use is made of the discharged water.

The WRC recommends that the definition of navigable waters (Section 502(7)) should be narrowed to exclude those bodies of water which have water in them only intermittently as a result of rain runoff or snowmelt, do not support fish, shellfish, or wildlife, do not provide water to downstream users, and do not flow into other water bodies.

NAVIGABLE WATERS AND WETLANDS

The overbroad definition of navigable waters also includes wetlands and requires that Section 404 Dredge and Fill permits not be issued unless specific steps have been taken to minimize adverse impacts on wetlands.

As a result of court decisions and agency regulations, the definition of wetlands has been expanded to include "vegetation typically adapted for life in saturated soil conditons". In the West, this results in land temporarily saturated from snowmelt runoff and irrigation falling under the jurisdiction of the Corps' 404 permit program.

Spring snowmelt and runoff cause steambeds to overflow and adjacent lands to be temporarily saturated. Wetlands-type vegetation appears even though the stream may be dry at other times of the year. This results in many areas adjacent to intermittent streams in semi-arid areas being considered wetlands. Even though activity on these areas or affecting these areas have no adverse effect on navigation or interstate water quality, permits are required for wetlands protection.

Furthermore, it is not uncommon for lands in western river valleys to be irrigated for farming or grazing purposes. As a result of the temporarily saturated soil conditions from irrigation, wetland-type vegetation occurs on the borders of irrigation ditches, as well as in irrigated pasture lands. Under the present law, no permit is required for the discharge of fill materials into an irrigation ditch, yet activity on the "adjacent" irrigated land may require a permit.

Mining and energy development are often located in rural mountain valleys where either one or both of these temporarily saturated soil conditions exist. The impact of such development can be widespread if a major development is proposed or it can be very localized if a single building is constructed. In either case, the Corps' present practice is to require developers to apply for a 404 permit. To help mitigate the impact, the Corps will either deny the permit, require costly alternatives to the project, or require costly habitat replacement.

This is objectionable not only because of cost, but because it assumes all wetlands, even irrigated pastures, are of equal importance and deserve the same degree of protection. Furthermore, it allows the Corps to assert jurisdiction in areas of traditional local and State authority.

The WRC recommends that the definition of navigable waters (Section 502(7)) be narrowed to eliminate artificial and/or seasonal wetlands. This can also be accomplished by exempting certain wetland areas under Section 404. These exemptions should include:

1. Lands adjacent to streams that either flow or overflow as a result of runoff waters.
2. Lands adjacent to isolated lakes, potholes, arroyos, intermittent streams and other waters that are not part of a tributary system to interstate waters or navigable waters.
3. Land areas containing wetlands-type vegetation as a result of irrigation practices.

Again, on behalf of the Western Regional Council, let me express our appreciation for the opportunity to participate in this hearing and to express our concerns on these two vital areas of interest to the West and the WRC.

Attachments

Western Regional Council proposed amendments to the Clean Water Act for Point Source Definition and Zero Discharge Goals:

POINT SOURCE DEFINITION

Amend Section 502(14) of the Act, 33 U.S.C. 1362(14), to read as follows:

> The term "point source" means any discernible, confined and discrete conveyance, incuding but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft from which pollutants are or may be discharged. The term does not include return flows from irrigated agriculture or stormwater runoff. As used herein, "stormwater runoff" means discharges from conveyances or systems of conveyances (including pipes, conduits, ditches, and channels) primarily used for collecting and conveying precipitation runoff and which are not contaminated with process wastes, raw materials, toxic pollutants in excess of toxic pollutant effluent standards or prohibitions, hazardous substances in reportable quantities, or oil and grease.

This proposed language is generally consistent with the U.S. Environmental Protection Agency's November 18, 1982 regulatory proposal.

ZERO DISCHARGE GOALS

Amend Section 101(g) to read:

> (g) It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall cooperate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution ~~in concert with programs for managing water resources.~~ consistent with state and federal programs for preserving and managing water resources.

TESTIMONY FOR THE JULY 6, 1983, HEARING
ON
THE STATE OF THE ENVIRONMENT:
A NEW MEXICO PERSPECTIVE

for the

SENATE COMMITTEE
ON ENVIRONMENT AND PUBLIC WORKS

By:
Bernard D. Zak, Ph.D., Supervisor
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AIR QUALITY ISSUES IN NEW MEXICO

B. D. Zak

Introduction.

New Mexico is known for its clean air and dramatic vistas. Visitors from all over the world come to see these vistas, producing a strong tourist industry. Over the past few decades, however, deterioration in visual and other air quality parameters has become significant. With the continuing economic development of the region, it is reasonable to presume that air quality will be increasingly threatened.

Local and Regional Issues.

It is useful to divide the relevant air quality issues into local and regional categories. By local issues, I mean those which affect the vicinity of sources of air pollutants out to a few tens of kilometers. By regional issues, I mean those which have a significant impact over an area hundreds of kilometers or more in dimension.

Local Issues and Dispersion in Complex Terrain.

In urban areas such as Albuquerque, high concentrations of carbon monoxide are correlated with degradation in visual range, primarily during winter stagnation episodes (Harley and Zak, 1982). During the summer, episodes of visibility degradation are correlated with elevated oxidant levels. Winter and summer, in the vicinity of smelters and power plants, the principal concern is sulfur dioxide levels.

Air quality in the vicinity of sources is strongly impacted by terrain effects in New Mexico. Sources, both urban and industrial, are most often located in valleys bounded on one or more sides by mountains. The dispersion of effluents in complex terrain is poorly understood. Air quality management is hampered by inability to adequately predict the impact of sources on ambient pollutant concentrations. Consequently, programs to develop the capability to adequately model dispersion of pollutants in complex terrain are particularly important to New Mexico and to the Mountain West in general.

Two complex terrain programs are now in progress. The Environmental Protection Agency effort is called the Complex Terrain Model Development (CTMD) program (Holzworth, 1980). It focuses on the impaction of plumes from stacks on elevated terrain. Two field studies have been carried out to date, the most recent at Hogback Ridge, near Farmington, New Mexico, and the Four Corners and San Juan power plants.

The Department of Energy effort, entitled Atmospheric Studies in Complex Terrain (ASCOT) is more generic in nature (Dickerson and Gudiksen, 1982). It focuses on nighttime and early morning mountain-valley airflows, and the potential for capture of pollutants in these flows resulting in high ground level concentrations. Three field studies have been conducted to date, the first two in the Geysers geothermal area of Northern California, and the most recent in the oil shale region of Colorado.

The importance of these programs has been recognized, and limited, though inadequate, funding has been provided to date.

Regional Issues and Long Range Transport.

In New Mexico and through much of the Southwest, one regional air quality issue is of as much or greater concern than local issues. That issue is regional visibility degradation. At present, the arid Southwest has the best visual air quality in the United States (Trijonis and Shapland, 1978), but that visual air quality is threatened.

Regional issues are tied to long range transport of air pollutants. If pollutants are transported over a long distance before natural processes remove them from the air, then the entire region will be affected by sources at a substantial distance. In the Southwest, the natural processes which remove pollutants from the air are less effective than elsewhere. Rain and snow are very efficient in cleaning the air, but in the Southwest, there is little precipitation. In the absence of precipitation, dry deposition at the ground still functions to remove pollutants. Deposition is enhanced by vegetation, but in the Southwest, there is less vegetation. Thus long range transport, important everywhere, is even more important here.

A start on understanding the problem was made by project VISTTA (Visiblility Impairment due to Sulfur Transport and Transformation in the Atmosphere), sponsored by the Environmental Protection Agency (Blumenthal et al.

1981), but that program has been terminated. Most resources for investigating regional air quality problems are now being dedicated to studying acid deposition in the Northeast. Our ignorance of acid deposition phenomena in the West has recently been pointed out (Porch, 1983), but as yet, there is no action to remedy that situation either.

Conclusion.

New Mexico shares much in common with the remainder of the Southwest: an arid environment, a vulnerability to long range transport of air pollutants, an inability to adequately predict the air quality impacts of local sources, copious energy resources, rapid economic development, and exceptional air quality threatened by the combination of all of the above. New Mexico also shares the need to understand the regional visibility degradation the Southwest is experiencing, and the need to predict air quality impacts in complex terrain. The programs cited--the EPA and DOE complex terrain programs, and a program to determine the nature and sources of regional visibility degradation in the Southwest--would meet those needs, and deserve support.

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Sandia National Laboratories
Albuquerque, New Mexico 87185

July 14, 1983

The Honorable Pete V. Domenici
Committee on Environment and Public Works
United States Senate
Washington, D.C. 20510

Dear Senator Domenici:

During the hearing of the Senate Environment and Public Works Committee in Albuquerque last week, you asked about the status and results of the Albuquerque Winter Visibility Study. I would like to answer your questions more fully than was possible at that time.

The sampling and measurement phase of the study began on December 28, 1982, and ended on February 23, 1983. This was nearly a month longer than originally planned. The reason for extending the measurement period was that this winter, Albuquerque had unusually stormy weather with less than usual visibility degradation during the originally planned 30-day period. With this extension, we were able to include more of the periods of degraded visibility of interest.

I feel that the measurements went exceptionally well. In spite of the very limited time available for preparations, we were able to get very nearly all of the data we sought, and to add certain useful measurements not originally planned. This success was due in large part to the assistance of the Environmental Protection Agency, particularly in providing certain equipment which Sandia did not have, and to the enthusiastic work of City of Albuquerque personnel, as well as to the efforts of Sandians.

Data processing and sample analysis began upon completion of the measurements. Processing of the real time data is nearly complete, but the sample analysis is behind schedule. The first phase of analysis of the 500 or so filter samples taken during the study is being done by the EPA at Research Triangle Park. An equipment failure at the EPA laboratory delayed the analyses. Since the hearing, I have been informed that the problem has been resolved, and that the initial analyses for light absorption and total mass are now done.

Elemental analysis of the filter samples will be undertaken as soon as the samples are received back from the EPA. It is estimated that completion of all remaining sample analyses will take six weeks to two months. Another six weeks will be required for data analysis using source apportionment techniques, and for report preparation. Consequently, we expect to submit a review draft of the final report to the City by the end of October. Thus the extension of the measurement period, coupled with the delay in sample analysis, will have added something over two months to the length of the project.

You also asked whether we will have obtained all the information needed for diagnosing the Albuquerque winter visibility problem, or if more should be done. I feel that a definitive answer to your question cannot be given until all the data is available and interpreted. It is true, however, that this past winter was atypical, and that some extrapolation will be necessary to apply the data to a more "normal" winter. Nonetheless, I would hesitate to say at this point that more work is required. When the data analysis is complete, we will know enormously more about the phenomenon than we did one year ago. What we have learned may be adequate to meet the City's needs in formulating its air quality management plans. Ultimately, that determination will be made by the City officials responsible for air quality control.

Enclosed you will find a copy of a newspaper article on the Visibility Study, published a day or two after your hearing. While it does contain one or two minor technical inaccuracies, it describes our current view reasonably accurately.

If you or your staff have any further questions, I will be pleased to provide whatever additional information I have at my disposal.

Sincerely,

Bernie Zak

Bernard D. Zak, Supervisor
Applied Atmospheric Research
Division 6324

BDZ:6324:184v:ss

Enclosure as above

Findings of Pollution Study Puzzle, Surprise City Officials

By NOLAN HESTER
Journal Staff Writer

Results from a study of Albuquerque's "brown cloud" of pollution won't be out until this fall, but prelimary findings have left city officials both surprised and puzzled.

The city, Sandia National Laboratories and the Environmental Protection Agency began the study last January as a cooperative research project to discover what causes the thick mantle of pollution that hovers over Albuquerque during the winter months. Using ground monitors, airborne balloons and even a low-flying helicopter, Sandia and EPA scientists scooped up air samples from all over town.

Bob Harley of the city's Environmental Health Department said preliminary data from Sandia's portion of the study shows that the winter temperature-inversion layer that traps Albuquerque's pollution is much lower than expected.

Nearly all the pollution is held within 100 feet of the ground by a higher layer of cool air, creating much higher concentrations than if emissions were diffused within a more typical 1,000-foot-high zone, he said.

"It's just a large garage out there with all those cars and fireplaces running," Harley said of the winter smog. "This could be a strong factor in why we have such bad pollution at that time of the year."

He said the preliminary information also indicates that the early morning smog that hangs over the city is not pollution from the previous night. Instead, there seem to be two distinct cycles of pollution; a daytime cycle dominated by auto emissions and a nighttime one that may stem from fireplace smoke.

Harley said it is far too early to point fingers at fireplace smoke, however, adding that only the EPA's samples can provide a definite answer.

Harley could offer no explanation for how smog could build up so rapidly in the morning without the aid of a night-time carryover. But he said the study shows that the pollution is locally generated and not sweeping in from outside the area.

While last winter had far fewer days of stagnant air conditions than normal, Harley said the study still will be helpful in deciding what new steps, if any, should be taken to control the city's brown cloud. "We may have missed the burglar," he joked. "But we'll still get a fingerprint."

While Sandia has finished its work, city officials are still waiting for the EPA to finish analyzing its samples of pollution particles.

Harley said the EPA tests will provide crucial clues in deciphering how much of the city's smog comes from vehicle emissions, blowing dust or belching fireplaces and wood-burning stoves.

The city-Bernalillo County auto emissions inspection program, begun last January, is the city's main weapon in cutting local air pollution. However, the inspections involve only invisible carbon monoxide fumes, leaving city officials with the problem of how to combat the highly visible brown cloud.

Harley said the EPA delay could interfere with the city's desire to use information in the first year's study to design a second-year study. "I'm sure people out there will be frustrated, like I am, about what to do" to reduce next winter's pollution, Harley said.

EPA official Dolores Johnson said the delay stemmed from the breakdown of some testing equipment at the EPA laboratory in North Carolina.

City and EPA officials met earlier this week and Harley said EPA has promised to "apply some pressure from their regional office back on the lab."

Even after the EPA finishes its work, Harley said it will take several more months to integrate their data into the full report, which might not be ready until October.

Testimony at the U.S. Senate Environment and Public Works
Committee Hearing on Major Environmental Issues in New Mexico,
Community Panel of Witnesses from the State's Research,
Albuquerque Public Library, July 6, 1983

by

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New Mexico Bureau of Mines and Mineral Resources,
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Introduction

In my testimony as a member of the panel from New Mexico's research community I will discuss several aspects of hazardous waste management, an issue of major environmental concern here and throughout the nation. My discussion primarily relates to problems of site selection for waste storage and disposal. This is an area of applied research in which I have been personally involved since 1977. My testimony also stresses broader-based research on hazardous wastes and the major problem of stabilization of uranium mine-mill wastes where strong EPA support seems appropriate, and reflects input from colleagues from NMSU and UNM as well as from NM Tech. Much of the documentation for my testimony is contained in a recent New Mexico Geological Society publication "Environmental Geology and Hydrology in New Mexico" edited by Dr. Stephen G. Wells of the UNM Geology Department and Dr. Wayne Lambert, formerly of the U.S. Geological Survey. Copies of this book are being submitted for background material for this hearing.

Hazardous Waste Management

Disposal Site Selection

Research to date on siting of hazardous waste management facilities has focused on development of criteria for site selection that are compatible with the State's natural environmental setting. Preliminary searches have also been made for areas suitable for landfill disposal of solid wastes. Between 1977 and 1981 informal consultation between the State EID and Bureau of Mines staffs resulted in formulating a provisional set of geologic, hydrologic and geochemical criteria for disposal of (nonradioactive) hazardous wastes (Table 1 and Figure 1; from Longmire and others, 1981).

During the past two years I conducted a study of possible sites for disposal of low-level radioactive wastes (non-DOD-DOE) for the Radioactive Waste Consultation Committee of the State Legislature. This work, in accordance with provisions of the "Site Identification Act" (HENRCS/NM House Bill 397, 1981), was done in cooperation with the Radiation Protection Bureau of the State Environmental Improvement Division. Table 2, from my report to the Committee (2/18/83), lists the siting criteria used; and information on five possible sites for low-level waste disposal facilities is given on Table 3 and Figure 2. Please note that the hazardous waste siting criteria of Longmire and others (Table 1) also served as the basis for the criteria used in the low-level radioactive waste study. Copies of the complete Radioactive Waste Consultation Committee report have been submitted as background material for the hearing record.

The criteria listed in tables 1 and 2 are relatively restrictive when compared with siting criteria developed for use in other parts of the United States. Strict adherence to these criteria should ensure that hazardous waste repositories will be placed at least 5 miles from even small centers of population or farming, mining, and industrial activity. They are very restrictive when compared with "location standards for new disposal facilities" in the current Hazardous Waste Management Regulations of the State Health and Environment Department (Parts 206.B.8, 302.A.4b) and the EPA.

The site selection process as applied to date in New Mexico attempts to locate those areas of the state where natural conditions (e.g. climate, landforms, geology, and hydrology) provide multiple barriers that reasonably assure long-term hazardous waste containment. Shallow burial of solid waste in a secure landfill is the basic disposal strategy envisioned in my studies. Such a landfill operation would be located in the upper part of a very thick zone of essentially-unsaturated earth material. Subsurface water-flow paths should be very long in both horizontal and vertical directions. Siting criteria require that the unsaturated zone contain a large percentage of fine-grained materials, such as clay or shale, which would physically and chemically retain waste components. There should be minimal degradation of land, water, and air quality in surrounding areas for thousands of years; and opportunities for human intrusion for resource development (e.g. soil, water, mineral, energy) should also be minimal.

I should emphasize that my work on site selection involved 1) evaluation of a large body of published (but largely untested) siting criteria, 2) review of published and unpublished information on geology, hydrology, and soils and 3) brief visits to areas with site potential. No onsite characterization work (such as test drilling) has been done, because funding and time limitations precluded detailed geologic and hydrologic study of specific localities. Other areas that meet siting criteria probably exist in the state; but the basic geologic and hydrologic data needed for site identification are not available. Selection of possible sites definitely reflects opinions developed during my local and statewide investigations of geology and soil relationships for the U.S. Soil Conservation Service between 1962 and 1977, and the Bureau of Mines and Mineral Resources since 1977.

The five possible sites located for the Radioactive Waste Consultation Committee (Fig. 2, Table 3) contain areas that may prove to be unsuited for any type of waste disposal. However, each site selected has a combination of natural features that essentially requires its consideration as a viable candidate for disposal of hazardous waste in solid form (e.g. water table depths from 500 to 1000 ft, hundreds of feet of clay-shale in the shallow subsurface, and absence of known aquifers). Even though the original purpose of my study was to locate areas for possible disposal of low-level radioactive waste, the sites also include many of the best locations in New Mexico for secure-landfill disposal of many types of hazardous wastes. These areas definitely deserve consideration as locations for processing and temporary storage facilities; and they could be used for generic pilot studies of various waste management strategies.

I am well aware of the immediate need for secure landfill sites for hazardous waste disposal in major urban and industrial areas such as the Albuquerque area. However, having just completed a rather comprehensive siting investigation I feel qualified to testify on the pitfalls associated with this type of applied research. My basic philosophy is that Murphy's law always pertains to hazardous waste management; and I feel that our "best" sites should really be classed as our "least bad" disposal sites. I believe that we must accept the basic premise that no single site will meet all siting criteria. The fundamental process of criteria selection is always state-of-the-art and subjective to say the least. Too often the tendency has been to pick a seemingly viable site and then try to design siting criteria that fit the field situation.

In New Mexico (as in any arid region) hydrology and geology are powerful socioeconomic, cultural, political forces. Historically there has been no intensive land use without a water-, mineral- or soil-resource base. Water availability obviously is the key factor. A valid question remains: Is the worst place for economic survival in this region really the best place for hazardous waste disposal? If I were from a much more humid and populated part of the country (and I have lived and worked in such areas), I could easily believe that vast areas of the Southwest are full of potential waste disposal sites. I am therefore quite concerned that the seemingly restrictive siting criteria that I have used will lull many into a false sense of security about our ability to cope with present and future hazardous-waste disposal problems. I fear that we may choose to continue dumping a wide variety of hazardous wastes in landfill and injection well operations, instead of reserving such facilities for a final product or ultimate residue of an intensive waste treatment effort. The technology for waste processing is available and its use should be encouraged. Better to do it right the first time than to expect the environment to be restored by various remedial measures paid for out of some sort of nebulous superfund.

I add this word of caution precisely because we are in a relatively dry and sparsely populated region where hydrologic and surficial geologic processes appear to act very slowly in many places. We know that many hazardous substances decay very slowly and exist in undiluted form for long periods simply because of our arid conditions. We also have a great deal to learn about the behavior of fluids and gases, particularly organic compounds in thick unsaturated zones of dry regions. In a region of limited water supplies and ground-water recharge opportunities, we cannot afford any type of aquifer contamination. These observations lead me to request that the EPA give strong support to research efforts that will help us deal more adequately with the many uncertainties of hazardous waste management. We need all the help we can get to limit the number of time bombs we leave to future generations.

Proposal for a Hazardous Waste Task Force

The following statement is taken from the Executive Summary of a "Proposal for a Hazardous Waste Task Force" submitted by the Director of the New Mexico Engineering Research Institute, UNM, to members of the State Legislative and Governor Anaya on Feb. 2, 1983. The proposal was initiated by Dr. Marx Brook, Director of the Research and Development Division at New Mexico Tech. Much of the basic material was prepared by Dr. Daniel B. Stephens, Assoc. Prof. of Hydrology at New Mexico Tech, Dr. Dennis Zalen of the New Mexico Engineering Research Institute at UNM, and Delmar Calhoun, Institute Director. A number of other researches at UNM, NMSU, and NM Tech and State EID personnel have also contributed to this document.

A licensed hazardous waste treatment, storage and disposal facility in New Mexico is urgently needed. A facility strategically located near waste generators, without threat to health or environment, would provide an incentive for industries to locate in New Mexico. High costs for out-of-state waste transportation have led to illegal dumping of hazardous wastes, a practice which would be curtailed by an in-state facility.

At the present time the applicant for a State-issued permit to operate a hazardous waste treatment and disposal facility selects a site and describes the design and operation of the proposed facility. The Hazardous Waste Bureau of the Environmental Improvement Division (EID) then review the proposal, based mostly on studies and information provided by the applicant.

New Mexico and industry would be well served if, 1) suitable siting regions were already identified when an application is first filed, and 2) critical evaluations of state-of-the-art technologies in hazardous waste management were available to aid permit reviewers and the public. There is a potential conflict of interest in performing this work by the regulatory agencies themselves.

Interdisciplinary task groups from the State's major research institutions are proposed to address the two deficiencies outlined above; however, subcontracting to reputable consulting and drilling firms is both desirable and anticipated. The scope of work is very broad, including, among other areas, field and laboratory studies, computer analyses, economic analyses, thorough literature surveys and inspections of existing sites.

According to the proposal, representatives of the task groups would comprise a Hazardous Waste Task Force, administered by the Director of the New Mexico Engineering Research Institute. In addition, an Advisory Committee appointed by the governor, would represent interested citizens, legislators, industry representatives, State agencies, and national laboratories. Objectives are outlined below.

A. Designate regions within New Mexico which may be acceptable to the public and industry for locating hazardous waste treatment, storage, and disposal facilities. Task group research functions include:

1. Site criteria evaluation.
2. Development of siting methodology.
3. Site ranking.
4. Field and laboratory investigations.
5. Contamination potential predictions.

B. Inventory the existing hazardous waste quantities, compositions, locations, generation process and handling. Task group research functions include answering the following questions:

1. How much hazardous waste is there?
2. What are the hazardous wastes?
3. Where and how is waste generated and handled?

C. Compile and evaluate the state-of-the-art for technologies in hazardous waste treatment, storage, and disposal, including economic considerations, potential environment impacts, and public relations, as they may pertain to conditions in New Mexico. Task group research functions include evaluation of:

1. Incineration for the disposal of hazardous wastes.
2. Waste exchanges-extraction of hazardous materials from waste streams for reuse.
3. Neutralization and chemical treatment.
4. Stabilization and solidification.
5. Lagoons, ponds and engineered storage.
6. Biological treatment.
7. Deep well injection.
8. Landfilling

Preliminary estimates of project duration and basic funding level are about 3 years and $1,800,000. Copies of the complete proposal have been submitted as background material for the hearing record.

Some Specific Problem Areas That Deserve Further Interaction between EPA Staff and the New Mexico Research Community

1. Need for a major research effort on appropriate management strategies for stabilization of uranium mill tailings and mine spoil. In terms of volumes of radionuclide and heavy metals that exist in a relatively unstable near-surface environment, this is probably the biggest problem we face in northwestern New Mexico.
2. Need for large-scale, in-depth, studies of fluid and waste movement in semi-arid terrain. Generic research is particularly needed on hazardous waste interaction with the soils and surficial geologic formations that occur along waste transportation routes and near waste management facilities.
3. Need for research on:
    a. Detection of significant leaks in waste-water injection wells.
    b. Adequacy of current guidelines for mechanical integrity tests of injection wells,
    c. Protection and rehabilitation of fresh-water aquifers near waste-water injection wells.
4. Need for research on maximum permissible concentrations of contaminants in drinking water. Many standards are set by the lower detection limit of instrumentation. Improved instrumentation and long-term toxicological studies should continue, particularly with respect to hazardous waste.

5. Need for improved interaction with EPA's research laboratories and the National Center for Ground Water Research through cooperative studies with universities and funding of competitive research proposals.

References and Documents Cited

Hawley, J. W., 1983, Site Identification for Low-Level Radioactive Waste Disposal in New Mexico: New Mexico Bureau of Mines and Mineral Resources, Report to the Radioactive Waste Consultation Committee of the New Mexico State Legislature. 16 p., 8 figures, and 6 tables.

Longmire, P.A., Gallaher, B. M. and Hawley, J. W., 1981, Geological, Geochemical, and Hydrological Criteria for Disposal of Hazardous Wastes in New Mexico: New Mexico Geological Society, Special Pub. 10, p. 93-102.

New Mexico Engineering Research Institute, 1983, Proposal for a Hazardous Waste Task Force (submitted to New Mexico State Legislators and Governor Anaya 2/2/83), NMERI, University of New Mexico, Campus Box 25, Albuquerque, NM, 87131.

Wells, S. G., and Wayne Lambert, editors, 1981, Environmental Geology and Hydrology in New Mexico: New Mexico Geological Society, Special Pub. 10, 152 p.

An overview of Patents, Publications and Specially Funded Research at NM Tech follows:

Overview of Patents, Publications and Specially Funded Research at NM Tech on Topics of Environmental Concern, 1981 and 1982.

Biology	Principal Investigators
Microbial processes for removal of suspended inorganic particulates from selected industrial waste waters.	C. A. Brierly
Bacterial processes for transformation of metals	J.A. and C.A. Brierly
Oil shale environmental research and coordination.	J.A. and C.A. Brierly
Availability of a hexachlorobiphenyl isomer to benthic amphipods from experimentally contaminated natural sediments	T.R. Lynch

Chemistry	
Effects of uranium milling and mining on surface water	D.K. and L.A. Brandvold, and C.J. Popp
Effects of coal burning on air and surface-water quality	W.Ohline, D.K. and L.A. Brandvold and C.J. Popp
Precipitation analyses in central New Mexico	C.J. Popp and D.K. and L.A. Brandvold
Radionuclide and heavy metal distribution in recent sediments of major streams of the Grants Mineral Belt	C.J. Popp, J.W. Hawley, and D.W. Love
Evaluation of sediments in the Middle Rio Grande, and Caballo and Elephant Butte Reservoirs as potential sources for toxic materials	T.R. Lynch, C.J. Popp, and D.K. Brandvold

Geology and Hydrology	
Geology and environmental concerns (in cooperation with New Mexico Geological Society)	J.W. Hawley and D.W. Love
Geological, geochemical and hydrological criteria for disposal of hazardous wastes (in cooperation with NMEID)	P.A. Longmire, B.M. Gallaher and J.W. Hawley
Site identification for low-level radioactive waste disposal (in cooperation with NMEID)	J.W. Hawley
Urban and environmental geology of Albuquerque area (in cooperation with NM Geological Society)	P.W. Lambert, J.W. Hawley, and S.G. Wells
Changes in soil physical properties due to organic waste applications	R. Khaleel
Transport of potential pollutants in runoff water from land areas receiving animal wastes	R. Khaleel

Geology and Hydrology (cont'd)	Principal Investigators
Fluid waste movement through the vadose zone	D.B. Stephens
Mining and Metallurgy	
Navajo refinery waste-water discharge survey	J. Purcell
Extraction of alumina from fly ash from coal-burning electric power plants (patent)	A. Torma
Physics	
Means and methods for removing airborne particulates from an aerosol stream (patents)	M. Brook
Determination of lead-210 in environmental samples	S. Schery
Radon distribution in the environment	M. Wilkening

Table 1. Summary of hydrologic, geologic, and geochemical siting criteria for hazardous waste disposal.

HYDROLOGY

The most important consideration in selection of sites for hazardous-waste disposal is the protection of ground and surface water from contamination by wastes or waste byproducts. Protection of aquifers—geologic materials that contain water which can be utilized by man—is extremely important.

General Criteria

A. A thorough evaluation of specific sites should be made, including determination of the direction and rate of ground-water flow, depth to the water table and nature of water level changes, and disposition of aquifers and their relationship to the hydrology of the site and the surrounding area.

B. The site should be at least 8 km (5 mi) from the maximum flood plain or lake shoreline of perennial surface waters.

C. The site should be at least 4 km (2.5 mi) from any well or spring tapping a major aquifer (min. yield 380 l/min [100 gal/min]).

D. The disposal excavation should extend into relatively impermeable host material. The landfilled solid waste should be entirely within the containing medium and below the base of any permeable surficial layer.

E. A minimum thickness of 46 m (150 ft) of relatively impermeable material should be present between the surface and any potential aquifer (min. yield 3.8 l/min [1 gal/min]).

F. A minimum thickness of 30 m (100 ft) of impermeable material should be present between the bottom of any proposed excavation and the historical high water table.

GEOLOGY

Geologic conditions in the vicinity of a proposed waste disposal site must be thoroughly analyzed. The lithology, thickness, areal extent, and permeability of geologic materials must be described and determined to be well suited for hazardous-waste disposal. Sites should not be located in areas which experienced major structural (tectonic), volcanic, or geothermal activity during middle to late Quaternary time.

General Stratigraphic and Lithologic Criteria

A. Minimum hydraulic conductivity and unsaturated thickness values for a suitable host material are 10^{-7} cm/s (3.3×10^{-8} ft/s) and 46 m (150 ft) of shale or clay, except where water-table depth exceeds 91 m (300 ft).

B. Examples of stratigraphic units that should be considered.

1. *Type I.* Marine shale and other clay-rich rocks with high potential for long-term containment of hazardous waste in semiarid regions where the water table is at least 46 m (150 ft) below the land surface.
   - a. Pierre Shale (Upper Cretaceous)—Great Plains (Raton section), northeastern New Mexico.
   - b. Mancos and Lewis Shales (Upper Cretaceous)—Colorado Plateau province, northwestern New Mexico. (Note: less favorable than Pierre Shale.)
2. *Type II.* Continental, intermontane basin deposits (upper Cenozoic) with high potential for long-term containment of hazardous waste in arid regions where water table is at least 91 to 152 m (300 to 500 ft) below the surface.
   - a. Santa Fe Group playa and fluvial facies (>50 percent impermeable strata)—Basin and Range province (Rio Grande rift), central and southern New Mexico.
   - b. Equivalent bolson deposits, in part Gila Group—Basin and Range province, southwestern New Mexico.
3. *Type III.* Continental basin deposits (lower Cenozoic and Mesozoic) with some potential for long-term containment of hazardous waste in semiarid and arid regions where water table is at least 91 to 152 m (300 to 500 ft) below the surface.
   - a. Nacimiento and San Jose Formations (Paleocene and Eocene)—Colorado Plateau province (eastern San Juan Basin), northwestern New Mexico.
   - b. Chinle Formation (Triassic)—Great Plains province, northern and eastern New Mexico.

General Structural Criteria

A. Avoid areas where major tectonic deformation has occurred during the past 500,000 years. The geologic structure should be simple enough to be well understood and evaluated in terms of site suitability.

B. A thorough site investigation is needed to reveal the presence of faulting and jointing in the general area.

C. Minimum distance of 1.6 km (1 mi) to any major fault, flexure, or other tectonic feature.

D. Avoid areas with anomalous heat flow or other evidence of major geothermal activity.

E. Avoid areas with volcanic or seismic activity.

General Geomorphic Criteria

Geomorphic processes most likely to adversely affect site stability, and landforms that indicate various degrees of surface stability must be thoroughly evaluated. The site should be in a physiographic position naturally resistant to water and wind erosion, flooding, mass wasting, or subsidence.

A. Climate-process considerations. Sites should be located in arid and semiarid areas with low local relief where

1. mean annual precipitation does not exceed 425 mm (17 in), with 24-hr storm intensities no greater than 150 mm (6 in);
2. annual evaporation (Class A pan) exceeds precipitation by at least 1,524 mm (60 in);
3. wind conditions in combination with resistant surficial materials inhibit deflation.

B. Slopes and other topographic factors associated with limited erosion-sedimentation rates require that sites be located where

1. local relief is low (e.g., broad summits of drainage divides);
2. natural slopes are in the 1 to 5 percent range;
3. distance to very steep slopes such as rim zones of escarpments exceeds 1.6 km (1 mi);
4. flooding or ponding or storm runoff cannot occur (flood plains, playas, and distal parts of piedmont slopes should be avoided).

C. Soil-geomorphic factors. Sites should be on stable geomorphic surfaces where absolute age-dating techniques and soil-profile characteristics (strong pedogenic horizons of carbonate and clay accumulation) indicate that surface ages exceed 10,000 years.

General Mineral, Land, and Energy Resource Criteria

Disposal sites should not be located in areas that appear to be subject to future intrusion for natural resource development, including mineral extraction, farming of rich agricultural soils, or geothermal energy development.

GEOCHEMISTRY

The chemical and physical compatibility of the host medium and waste material must be such that long term suitability within the closed system can be achieved and maintained. Detailed geochemical, mineralogical, and physical investigations must be conducted by empirical methods in order to precisely demonstrate the exact nature of the compatibility between the waste material and host medium.

General Recommendations

A. Collect baseline data on aqueous geochemistry in the site area (subsurface and surface).

B. Perform detailed mineralogical, physical, and chemical studies on the selected clay minerals in order to determine their exact suitability or compatibility with the various types of pollutants (inorganic and/or organic).

C. Determine the chemical-physical relationship between the clay minerals and the specific wastes to be disposed of by conducting laboratory studies coupled with in situ (on the site) observations. Various physical and chemical parameters to consider include pH, Eh, ion exchange capacities, precipitation products, adsorption mechanisms, etc., of the clay mineral and the types of pollutant.

D. Frequent field inspections, such as soil and water sampling, should take place during operation of the facility in order to assure that a closed system between the waste disposal site and the surrounding media is constantly maintained and to verify or modify the assumptions and interpretations utilized in the original suitability studies.

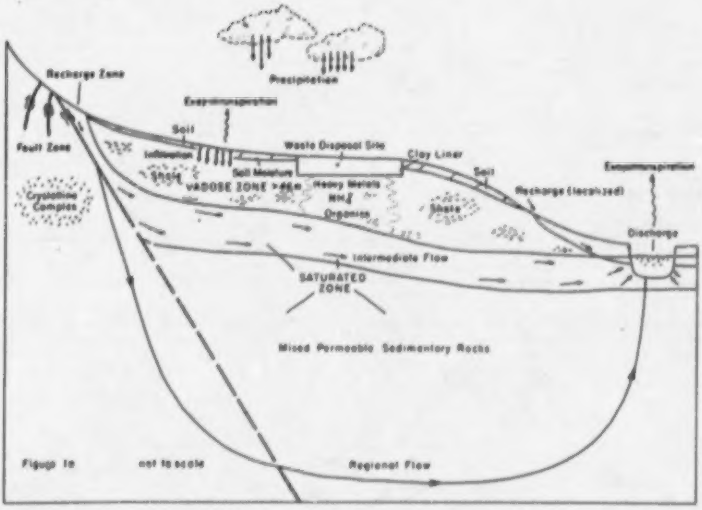

Precipitation
Recharge Zone
Evapotranspiration
Fault Zone
Soil
Infiltration
Waste Disposal Site
Clay Liner
Soil Moisture
Shale
VADOSE ZONE >60m
Heavy Metals
NH4
Organics
Crystalline Complex
Soil
Recharge (localized)
Evapotranspiration
Shale
Discharge
Intermediate Flow
SATURATED ZONE
Mixed Permeable Sedimentary Rocks
Figure 1a
not to scale
Regional Flow

Figure 1a. Diagram of Type I shale repository showing host-rock interaction with the hydrosphere in a Great Plains setting.

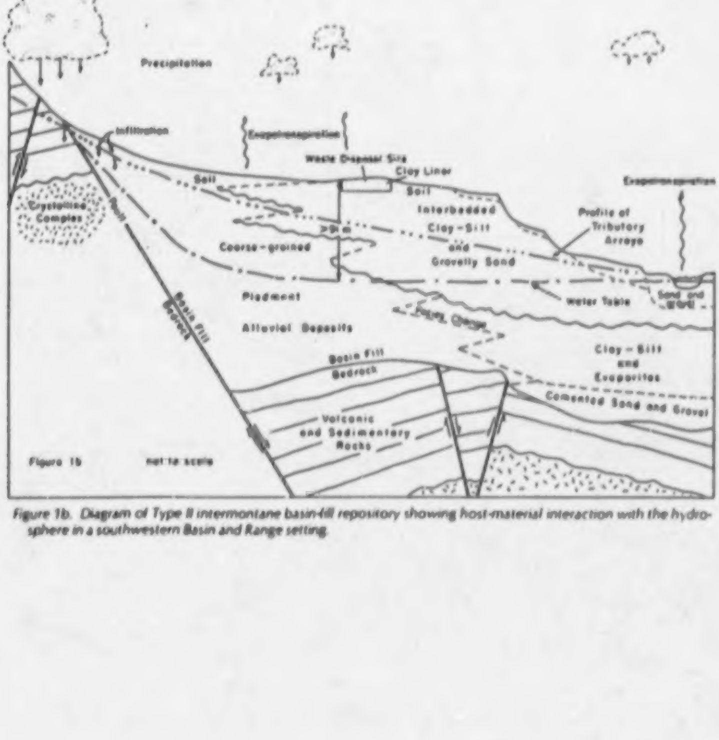

Precipitation
Infiltration
Evapotranspiration
Waste Disposal Site
Clay Liner
Soil
Soil
Crystalline Complex
Fault
Interbedded
Clay-Silt
and
Gravelly Sand
>91m
Coarse-grained
Profile of Tributary Arroyo
Evapotranspiration
Piedmont
Alluvial Deposits
Water Table
Sand and Gravel
Facies Change
Basin Fill
Bedrock
Basin Fill
Bedrock
Clay-Silt
and
Evaporites
Cemented Sand and Gravel
Volcanic
and Sedimentary
Rocks
Figure 1b
not to scale

Figure 1b. Diagram of Type II intermontane basin-fill repository showing host-material interaction with the hydrosphere in a southwestern Basin and Range setting.

TABLE 2. GEOLOGIC AND HYDROLOGIC SITING CRITERIA FOR LOW-LEVEL WASTE DISPOSAL IN NEW MEXICO

I. The most important goal in waste disposal is to prevent contamination of surface and ground waters and the atmosphere. Key to achieving this goal is to prevent the uncontrolled release of fluid, gaseous, and particulate wastes at a disposal facility. Meteoric water must be precluded from entering a containment facility and leachate must not be allowed to leak from the facility. The wastes must be isolated from the atmosphere and biosphere, as well as from surface and subsurface hydrologic systems. A thorough understanding of the local and regional environmental setting is needed to accomplish the desired isolation and assure long-term site stability.

II. Land, Mineral and Energy Resources.

Sites should not be located in areas where future natural resource development could adversely affect site integrity. Potential activities include irrigation agriculture, mineral extraction, and geothermal energy development (Anderson and Baker, 1974; Siemers and Austin, 1979; U.S. Geological Survey, 1981; Summers, 1979).

III. Surface Processes

Geomorphic processes that adversely affect site stability, and landforms or surficial deposits that indicate various degrees of surface stability must be thoroughly evaluated. The site should be in a physiographic position naturally resistant to water and wind erosion, flooding, mass wasting or subsidence (Hawley and Love, 1981; Nyhan and Lane, 1980; Wilson, 1973; Holzer and Pampeyan, 1981).

A. Climate-process considerations:

1. Sites should be located in arid and semiarid areas with low local relief.

2. Mean annual precipitation should not exceed 405 mm (16 in), with 24-hr storm intensities no greater than 200 mm (8 in).

3. Annual evaporation (Class A pan) should be at least 60 in .

4. Surficial materials and natural vegetation cover should inhibit wind erosion (deflation).

B. Slopes and other topographic factors associated with limited erosion-sedimentation rates:

1. Local relief should be low (elevation range of less than 300 ft in an area of less than 25 square miles)

2. Natural slopes should be $\leq 5\%$.

3. Where slopes are very low (<1%), they should not be susceptible to flooding or ponding from storm runoff. Avoid all floodplains and lake plains.

4. Avoid areas of active erosion-sedimentation, including areas of thick alluvial and eolian deposits of Holocene age (10,000 yrs).

5. Distance to very steep slopes such as rim zones of escarpments should exceed 1 mile.

6. Surficial geologic units should not contain deposits emplaced by mass wasting, such as landslide and debris-flow units.

C. Soil-geomorphic factors. Sites should be on stable geomorphic surfaces where absolute age-dating techniques and soil-profile characteristics (strong pedogenic horizons of carbonate and clay accumulation) indicate that surface ages exceed 10,000 years.

IV. Geologic Structure and Volcanic Features

The geologic structure should be simple enough to be well understood and evaluated in terms of site suitability. A thorough investigation is needed to reveal the presence of faulting, folding, and jointing in the general site area.

A. Avoid areas of major tectonic deformation (e.g. complexly folded and faulted rocks associated with rugged terrain).

B. Site should be at least 1 mile from known faults with movement during the past 500,000 years (Machette, 1982; Seager, 1980).

C. Site should be at least 1 mile from volcanic centers with known activity during the past 500,000 years.

D. Avoid areas with major historical seismic activity (local magnitude, $M_L \geq 4$), or anomalous vertical crustal movements. See Sanford and others (1981), and Reilinger and others (1979).

E. Avoid areas with anomalous terrestrial heat flow. See Reiter and others, (1979).

TABLE 2 (continued)

V. Geohydrology

Ground and surface water must be protected from contamination by low-level wastes or waste byproducts (Wilson, 1979, 1981). Protection of aquifers--geologic materials that contain recoverable water of suitable quality for human consumption--is of primary importance. Aquifers are characterized by minimum well yields in the 1 to 10 gpm range, and water quality is in the fresh (<1,000 mg/L total dissolved solids-TDS) to slightly saline (1,000-3,000 mg/L TDS) range. (Saline water exceeds 3,000 mg/L TDS.)

1. The preliminary evaluation of possible site areas should include determination of depth to water table or piezometric surfaces; direction of groundwater flow; distribution of aquifers and confining beds; and nature of major geochemical components of the flow system.
2. The site should be at least 5 miles from the maximum floodplain or lake shoreline of perennial surface waters.
3. The site should be at least 5 miles from any well or spring tapping a major aquifer (minimum yield 100 gpm of fresh water).
4. Where unconfined ground-water conditions exist, the water table should be at least 300 feet below the surface.
5. If the unsaturated zone is less than 300 ft thick, at least 150 feet of clay-rich, relatively impermeable materials should be present between the surface and any potential aquifer. Recommended hydraulic conductivity values for clay-rich materials should not exceed 10^{-7} cm/sec (e.g. under unit head fluids would migrate 0.1 ft/yr or less).
6. Where relatively impermeable, clay-rich materials extend from the surface (or near-surface) into the saturated zone, confined ground-water conditions usually exist; and it is often impossible to determine unconfined "water-table" configurations. Piezometric surfaces associated with underlying confined aquifers should be at least 300 feet below the land surface.
7. Major areas of the state where unsaturated zones exceed 300 ft in thickness should get special scrutiny for possible disposal sites.
8. Areas of the state with known "dry hole" water tests in thick, clay-rich units should also receive special attention.
9. Areas where ground-water flow is primarily through fractures or solution-enlarged conduits should be avoided.

VI. Hydrogeologic Settings for Waste Repositories

A. Site areas underlain by fine-grained marine rocks.
Clay-rich marine rocks (shales, claystones, mudstone) locally have good potential as host materials. Smectite-type clay minerals with large ion-adsorptive and expansive properties, are major constituents. Units are very impermeable and commonly saturated or nearly saturated with saline water. (Type I material of Longmire and others, 1981.)

Representative formations:

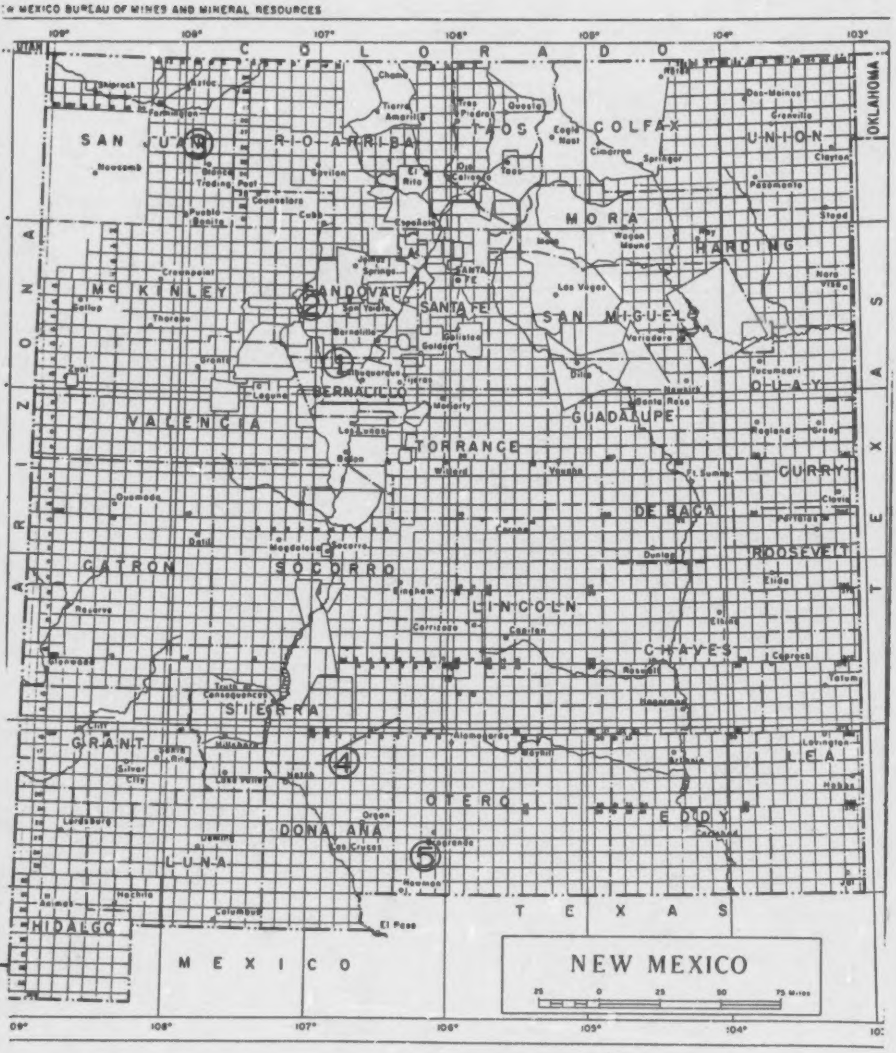
1. Pierre Shale and Smoky Hill Marl Mbr-Niobrara Fm (Upper Cretaceous). More than 2,000 ft thick in parts of Colfax County southwest of Raton (fig. 8f).
2. Mancos Shale (Upper Cretaceous) as much as 1200 ft thick in parts of San Juan Basin-Colorado Plateau (fig. 8b).

B. Site areas underlain by basin and valley fill.
Sand, silt, clay and gravel (unconsolidated to partly indurated); locally thousands of feet thick. Exhibits wide range in texture and geochemical properties (e.g. lake clay, dune sand, gravelly fan alluvium, and river sand and gravel). (Type II material of Longmire and others, 1981). Representative units include:

1. Ogallala Fm. Upper Miocene alluvial and eolian deposits on the High Plains. This major aquifer is unsuited for waste repositories of any type.
2. Santa Fe Group. Major fill unit of intermontane basins in central and southern New Mexico. River and stream deposits of late Miocene to middle Pleistocene age form major aquifer. Clay-rich, partly-saline and zeolitic, lake and playa deposits locally make up large part of unit in bolson-floor areas (e.g. sites 4 and 5, figs. 1 and 7). Unit ranges up to 16,000 feet thick in parts of the central Albuquerque Basin where it constitutes one of the great aquifers of the nation. Interbedded sand, silt, clay and gravel of the Santa Fe Group also underlie the extensive Llano de Albuquerque tableland situated between the Rio Grande and Puerco valleys. In that area the unsaturated zone is as much as 1,000 ft thick (site 1, figs. 1 and 7).

C. Site areas underlain by older continental deposits.
Shale, mudstone, siltstone and sandstone (in places poorly consolidated); locally several thousand feet thick. Unit includes stream and lake deposits of early to middle Tertiary age in the Colorado Plateau and Basin and Range Provinces. (Type III materials of Longmire and others, 1981). Representative units include:

1. Nacimiento Fm. Lower Tertiary alluvial and lacustrine unit in the San Juan Basin that is primarily shale, but which locally contains lenticular, water-bearing sandstone beds (site 3, figs. 1 and 7).
2. Clay- to sand-rich clastic deposits, commonly zeolitic; primarily conglomeratic debris-flow units and mudstones associated with middle Tertiary volcanic terranes of southwestern New Mexico (e.g. Spears, Palm Park, Rubio Peak Fms). Unit may prove to be important host rock for waste repositories.


MEXICO BUREAU OF MINES AND MINERAL RESOURCES
COLORADO
ARIZONA
OKLAHOMA
TEXAS
MEXICO
NEW MEXICO
SAN JUAN
RIO ARRIBA
TAOS
COLFAX
UNION
MORA
HARDING
McKINLEY
SANDOVAL
SANTA FE
SAN MIGUEL
BERNALILLO
VALENCIA
TORRANCE
GUADALUPE
QUAY
CURRY
DE BACA
ROOSEVELT
CATRON
SOCORRO
LINCOLN
CHAVES
SIERRA
GRANT
OTERO
EDDY
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DONA ANA
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103°

Figure 2. Five possible sites for disposal of low level radioactive wastes
1.Llano de Albuquerque 2.Prieta 3.Huerfano 4.Jornada 5.Desert

TABLE 3. INSTITUTIONAL AND CULTURAL FEATURES AT POSSIBLE SITES FOR LOW-LEVEL WASTE DISPOSAL

SITE NUMBER	1	2	3	4	5
COUNTY	Bernalillo	Sandoval	San Juan	Doña Ana	Otero
SITE NAME	Llano de Albuquerque	Prieto	Huerfano	Jornada	Desert
QUADRANGLE(S)	Albuquerque 2° Volcano Ranch 7-1/2' Sky Village SE 7-1/2'	Albuquerque 2° Ojito Spring 7-1/2' Cabezon Peak 7-1/2' San Luis 7-1/2?	Aztec 2° Bloomfield 15' Huerfano Trad. Post NW Huerfano Trad. Post 7-1/2'	Las Cruces 2° Chicken Well 15' Kaylor Mtn 15'	Las Cruces 2° Elwood 7-1/2' Orogrande S 7-1/2'
TOWNSHIP/ RANGE/ SECTION	10N/1E/1,2 11N/1E/10,11,14,15,22, 23,25,26,35,36 12N/1E/21,22,27,28	15N/1W/6,7 15N/2W/1,12 16N/1W/18,19,30,31 16N/2W/13,14,23-26,36 17N/2W/7	26N/10W/10,11,14,15,22, 23,26,27,34,35	17S/2E/28-33,32-36 18S/2E/1-5,8-12	23S/8E/3-5,8-10, 15-17,20-22, 28-30,31-33
LAND GRANT-LONGITUDE/ LATITUDE	Town of Alameda	Formerly part of Ojo de Espiritu Santo Grant			
SITE AREA	>10 mi², 2 parcels	10 mi² (20 mi²)	10 mi²	25 mi²	36 Mi²
LAND OWNERSHIP	Private State (10/1/2,11/1/36)	Public (BLM)	Public (BLM)	DOD (WSMR) 13 mi² Public (BLM) 11 mi² State (17/2/32)	DOD (McGregor Rge Fort Bliss)
MAJOR LAND USES	Grazing Land Suburban Expansion	Grazing Land Gas Pipeline	Grazing Land Gas Pipeline 4 gas/oil wells	Grazing Land WSMR (Buffer zone)	Military, Highway and RR right-of-way
ESTIMATED DISTANCE TO NEAREST: Town	3-6 mi (suburban Albuquerque)	12 mi (San Ysidro)	15 mi (Bloomfield)	20 mi (Rincon)	3-15 mi (Orogrande)
Residence	Several on or near site	2 mi	1-5 mi	1-5 mi	3-15 mi
Perennial Stream	6-11 mi (Rio Grande)	12 mi (Jemez River)	13-18 mi (San Juan River)	17-23 mi (Rio Grande)	30-42 mi (Rio Grande)
Lake or Reservoir (downstream)	20-25 mi (Rio Grande floodplain)	23 mi (Jemez Reservoir)	NA	NA	NA
Irrigated Farm Land	6-11 mi	13 mi	5-10 mi (Navajo Irrig. Proj.)	17-23 mi	15-25 mi
Interstate Highway	4-12 mi (I-40)	29 mi (I-25)	80 mi (I-40)	15-21 mi (I-25)	25-36 mi (I-25)
Federal/State Hwy.	4-12 mi	5 mi (NM-44,NM-279)	<4 mi (NM-44)	20 mi	0-4 mi (US-54)
Railroad	0-13 mi	29 mi	80 mi (ATSF)	15-21 mi (ATSF)	0-4 mi (SP)
ARCHEOLOGICAL(A)/ HISTORICAL(H)/ CULTURAL SITES (C)	A-on site C-Albuquerque volcanoes, 1-7 mi	A-on site C-Cabezon Peak Wilderness Study Area, 2-5 mi	A-on site	A-on site	A-on site
REMARKS	Area may be expanded to north and south	Area may be expanded north into San Luis Quad (T16-17N,R2W)			Area considered because of highway and railroad right-of-ways
KEY REFERENCES	Bjorklund and Maxwell (1961); Black (1982); Black and Hiss (1974); Hacker (1977); Hawley et al. (1982); Kelley (1977); Lambert (1968); Machette (1978, 1982); Slack and Campbell (1976); Titus (1961)	Baltz (1978); Black and Hiss (1974); Craigg (1980); Kelley (1977); Maker et al. (1971a); Molenaar (1974); Slack and Campbell (1976); Woodward and Martinez (1974)	Baltz (1967); Brimhall (1972); Fassett and Hinds (1971); Keetch (1980); Maker et al. (1973); Parker et al. (1977); Stone et al. (1983); Wells and Rose (1981)	Bulloch et al. (1980); Gile et al. (1981); King et al. (1971); Maker et al. (1971b); Seager et al. (1983); Wilson et al. (1981)	Darr (1981); Hoidale et al. (1967); Knowles and Kennedy, (1958); Maker et al. (1972b); Seager (1980, 1981) Seager et al. (1983)

NEED FOR IMPROVED INTERACTION OF EPA's NATIONAL CENTER FOR GROUND WATER RESEARCH WITH WESTERN UNIVERSITIES*

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July 12, 1983

The allocation of EPA funds for ground-water research is a matter of concern to western states such as New Mexico. A greater emphasis on EPA funding of competitive proposals would increase the quality of research produced. EPA research was formerly conducted mostly at the Las Vegas, NV and Ada, OK laboratories. In 1979 EPA also formed the National Center for Ground-Water Research (NCGWR), a consortium comprised of the University of Oklahoma, Oklahoma State University and Rice University. Since 1982 the NCGWR at the University of Oklahoma has been associated with the Environmental and Ground Water Institute (EGWI) in the School of Civil Engineering and Environmental Science. According to EGWI's First Annual Report for July 1982 - July 1983, EPA funding at the University of Oklahoma alone included $420,000 for four research grants, $107,000 to NCGWR for basic operating funds and $15,296 from EPA research laboratories. The NCGWR budget and EPA funding comprises about 77% of the total 1982-83 budget for the University of Oklahoma's E.G.W.I. The EGWI annual report lists as faculty and research staff: a director, five full-time technical personnel, five graduate students, three associate and visiting full-time technical personnel, five graduate students, three associate and visiting full-time research staff members, and eleven other cooperating researchers and faculty. Although this group (principally its director) participated in a large number of conferences, there was only one paper published on the subject of ground water in a referred scientific journal in the period 1982-83. The journal in which it was published is not widely read in the ground-water community. On the basis of substantial support from EPA since 1979, greater public visibility and scientific productivity in the area of ground-water hydrology should be expected from a National Center for Ground Water Research.

It should be pointed out that there are many other schools which have established a reputation for excellence in ground-water research, such as: University of Arizona, Stanford University, University of California at Berkeley, New Mexico Institute of Mining and Technology, University of Nevada-Reno Desert Research Institute, Colorado State University, and University of Idaho, among others. Competition among these and other well-qualified institutions in the United States for research grants would be a more productive way of conducting many research activities which are relevant to EPA's objectives.

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*Statement in support of testimony by Dr. John W. Hawley to U.S. Senate Environment and Public Works Committee Hearing on Major Environmental Issues in New Mexico, July 6, 1983.

Environmental Geology and Hydrology in New Mexico

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[Note: The following has been excerpted from the above named report. The report, in its entirety, has been retained in the committee files.]

FOREWORD

New Mexico encompasses four physiographic provinces with diverse geologic, hydrologic, and vegetative characteristics: rolling grassland plains, elongate desert basins, high semiarid plateaus, and towering forested mountains. Much of this land occurs within zones of transition from one landscape or climatic type to another, creating an especially fragile natural environment. New Mexico is a state with abundant and rich energy and mineral resources including oil, gas, coal, uranium, copper, molybdenum, gypsum, and sand and gravel as well as geothermal, solar, and wind resources. Add to this setting a variety of people with different industrial and agricultural endeavors, cultural backgrounds, and political pursuits, and it is easy to see that New Mexico is a state with an ample share of environmental geologic and hydrologic concerns.

The interactions of humans with the geologic and hydrologic environment has been a fact of life since humans first set foot in what is now New Mexico. These interactions range from the attempt of Indians to halt the fall of Threatening Rock in Chaco Canyon several hundred years ago to the recent attempts of scientists to evaluate the suitability of bedded salt in southeastern New Mexico for the long-term disposal of radioactive wastes. As noted by Hawley and Love in this volume, the hallmark of environmental geology and hydrology is the gathering and presenting of scientific information to the public. The application of geology and hydrology as a means of maximizing advantageous use of the natural environment and minimizing adverse environmental changes requires a scientifically sound data base. W. C. Mendenhall, fifth Director of the U.S. Geological Survey, stated simply "There can be no applied science unless there is science to apply." In order to maintain a proper stewardship of our geologic and hydrologic resources, we must continue in our endeavors to acquire, analyze, and communicate scientific information.

This volume, which includes both regional overviews and detailed case studies, has been prepared for the meeting of the Rocky Mountain Section of the American Association of Petroleum Geologists in Albuquerque, April 13-15, 1981. The theme of this meeting is energy diversity, and in accordance with this theme, a majority of the articles in this volume reflect the diverse environmental concerns associated with energy-resource development in New Mexico. In addition, the volume contains articles dealing with the environmental geologic and hydrologic aspects of hazardous-waste disposal and watershed management. The articles have been contributed by scientists in private industries, consulting firms, universities, national laboratories, and State and Federal agencies. This diversity of contributors and affiliations indicates the broad spectrum of talents and interests that are currently being applied in the search for solutions to the complex environmental geologic and hydrologic problems facing the citizens of New Mexico.

The title of this volume, "Environmental Geology and Hydrology in New Mexico," is not intended to imply an exhaustive review of this topic, but rather is intended to illustrate some of the major environmental problems which face the State of New Mexico. These major problems are summarized in the four parts of this volume. Part 1 provides an overview of the regional geologic, hydrologic, and economic setting of New Mexico; Part 2 includes detailed studies concerning the interactions of humans and the hydrologic environment; Part 3 includes research related to energy-mineral development and the geologic and hydrologic environment; and Part 4 includes detailed studies concerning the geologic and hydrologic environment and the disposal of hazardous waste. We hope this volume will be enlightening and helpful to both the geologist and nongeologist.

We would like to thank H. E. Malde of the U.S. Geological Survey for contributing the photographs for the frontispiece and J. A. Salas for drafting several of the illustrations. A map of New Mexico showing localities mentioned in the articles but not shown in illustrations accompanying the articles can be found inside the front cover. A table of conversion factors is inside the back cover. The cover illustration of Navajo Churchrock near Gallup, New Mexico and the filler illustrations are from publications of the U.S. Geological Survey and the New Mexico State Engineer. Captions for the cover illustrations and filler illustrations are from the original works.

Stephen G. Wells
Wayne Lambert

New Mexico Geological Society, Special Publication No. 10, 1981, pp. 1–10.

OVERVIEW OF GEOLOGY AS RELATED TO ENVIRONMENTAL CONCERNS IN NEW MEXICO

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ABSTRACT

New Mexico faces a special set of environmental problems associated with rich mineral resources, a dry climate, and vast areas of low population. Complex interactions between geology and environmental concerns involve geologic processes that have adverse effects on human activities, and modern society's use of mineral, land, and water resources. Geologic processes include moderate-intensity earthquakes, surface subsidence due to rock dissolution, stream floods, debris flows, and landslides. Geologically related human impacts on the environment include surface and subsurface extraction of economic mineral deposits (primarily energy minerals), ground-water development, construction of dams and power plants, disposal of hazardous wastes, and establishment of large-area reserves for military operations and scientific research.

Geologists have a major role in helping solve environmental problems resulting from effects of geomorphic processes and development of mineral, water, and land resources. Inventories must be made of these processes and resources in order to put complex process-resource-human interactions in proper space and time perspective. Guidelines can then be formulated for mitigation or prevention of geology-related problems. For example, mined lands need to be reclaimed, cities need to be planned, and sites need to be selected for hazardous-waste disposal. Finally, geologists must clearly present available information on relationships between geology and human concerns. The hallmark of environmental geology should be effective communication with nongeologists.

INTRODUCTION

Modern technological society's use of the Earth produces an overwhelming variety of human-environmental interactions. The expanded outline which forms the body of this paper demonstrates that there are few, if any, aspects of geology that are unrelated to "environment" in the broad sense, i.e., "the surrounding conditions, influences, or forces that influence or modify . . . the whole complex of climatic, edaphic, and biotic factors that act upon an organism or ecological community and ultimately determine its form and survival" (Gove, 1971). The phrase "environmental concerns" implies limitations of this broad concept to those aspects of the environment, including geological processes and resources, that are of concern to current and future human affairs.

The impact of geology on human affairs, throughout New Mexico's history, primarily relates to development of mineral resources (Sheffer and Eveleth, 1978; U.S. Geological Survey, 1965; New Mexico State Engineer Office, 1967). In a 20th century context, energy-mineral and water-resources development dominates the environmental scene, as well as the economy, in many areas (Arnold and Hill, 1980; Grant, McLean, Wilson, this volume).

Another important aspect of environmental concerns is that New Mexico's open space has become a major resource in itself because of very dry climate and low population density. Vast areas are reserved for scientific research and technological development, including military weapons testing and civilian research in nuclear energy, space exploration, and radio astronomy. Also, vast areas have been reserved for recreation. In the past 30 years hazardous-waste disposal problems have developed. Long-term activities involve disposal of nuclear waste at Los Alamos (Rogers, 1977) and uranium-mine mill tailings in the San Juan Basin (Gallaher and Goad, Stephens and Siegel, this volume). Recent planning and site-specification studies on radioactive-waste disposal (Office of Nuclear Waste Isolation, 1980) have focused on potential repositories for military and commercial wastes, respectively, in deep-bedded salt deposits (Mercer and Gonzalez, Powers, this volume) and unsaturated materials near the land surface (National Research Council/ National Academy of Sciences, 1976; Winograd, 1974; Herkenhoff, G. and Associates, Inc., Summers, W. K. and Associates, 1977). In the past year there has been much public concern about industrial-waste production and disposal strategies (New Mexico Environmental Improvement Division, 1980). Longmire and others (this volume) discuss criteria for near-surface disposal of solid hazardous wastes; and aspects of liquid-waste (brine) disposal in oil and gas fields are described by Stephens and Siegel (this volume).

AN EXPANDED OUTLINE OF GEOLOGY IN RELATION TO ENVIRONMENTAL CONCERNS

Complex relationships between geology and environmental concerns in New Mexico are divided into three broad topics and many subtopics that are briefly outlined in Table 1. This table serves as an index (with standard alpha-numeric coding) to the expanded outline below. Figure 1 shows locations of physiographic features and towns mentioned in this paper. The major topics include the following:

I. Geological processes, materials and landforms as part of a dynamic earth-surface environment, their complex interactions, and their adverse effects on human affairs (geologic hazards).
II. Geological materials and landforms as resources, and their environmental impact with respect to mineral development, intensive land use, and preservation of scientific, scenic and cultural values.
III. Geological contributions to the inventory, planning, and site-selection process as part of a statewide environmental geology program.

Topics I and II are presented in the context of human affairs versus the environment; whereas, geologists normally view processes (I) and resources (II), respectively, as phenomena for scientific study and commodities of significant economic value. Topic I emphasizes the impact of processes such as earthquakes, landslides, and floods on human activities, while Topic II stresses adverse environmental impacts of human development of natural resources.

Topic III is presented in the positive context of the important role geology plays in the inventory and planning process. The applied field of "environmental geology" (Hawley, 1980; Sheldon, 1977; Wermund, 1974) places geologic processes and products in perspective in terms of time, space, and human affairs. The principle of uniformitarianism is extended to include a forward look in which what we know about the past and present is used as a key to unlock the door to the future. Environmental geology is geology for nongeologists. What we geologists know and what we infer about geologic processes and products, and degrees of uncertainty, must be clearly expressed.

The expanded outline that follows is not a formal policy statement and it does not advocate any particular strategy for mitigation of hazardous processes, development of natural resources, or selection of sites for environmentally sensitive activities. It simply provides a state-of-the-art perspective of what various individuals, industries, and institutions are accomplishing in this important area of applied geology. Literature cited reflects a small representative part of recent work in the southwestern United States. The conceptual framework (Table 1) is derived from several sources (including Bloom, 1978; Brown, 1974; and Thornbury, 1969). There are many topical gaps that should be filled, and the logic of the outline can be improved in a number of places. However, if used with some degree of charity and humor, the expanded outline should serve as a useful guide to environmental geology in New Mexico.

I. Geological processes, materials, and landforms as part of a dynamic earth-surface environment. Included are geomorphic processes which relate specifically to landform genesis. Processes which adversely affect humans are termed *geologic hazards*.
   A. Effects of deep-seated (hypogene) geomorphic processes; including structural deformation, volcanism, and related seismic activity.
      1. Structural deformation and earthquakes; associated with tectonic features such as folds and fracture systems. Moderately large earthquakes and slow, differential surface warping have been noted in historical records (Reilinger and others, 1979; Sanford and others, 1979). Historic formation of fault scarps in the region has not been reported except in adjacent parts of Sonora (about 160 km south of Lordsburg) during the 1887 earthquake (DuBois and Smith, 1981). However, prominent scarps of Holocene age (<10,000 years) are present in several parts of the Basin and Range province (e.g., east of Las Cruces, and west of Socorro and Lordsburg).
      2. Volcanic activity. No eruptions have occurred during historic time (Luedke and Smith, 1978); but three basalt centers were active during earlier parts of the Holocene Epoch, resulting in extrusion of flows near Capulin (east of Raton), Carrizozo, and McCartys (east of Grants).
      3. Geothermal activity. Anomalous heat flow and hot spring activity has been noted in many parts of the State, particularly in and near the Rio Grande rift (Reiter and others, 1979; Summers, 1979).
   B. Effects of surface and near-surface (epigene) geomorphic processes; including mass wasting and water and wind activity. Human actions can have a significant impact on these processes.
      1. Mass wasting; including landslides, rockfalls, and debris and mud flows (in part triggered by earthquakes, e.g., Sonoran earthquake of 1887, DuBois and Smith, 1981). Steep slopes on shales and other weak rocks surmounted by competent caprock units are particularly susceptible to mass wasting.
         a. Active landslides are major hazards in canyons of large streams and in high mountain areas with cool and moist climates.
         b. Debris and mud flows occur in many parts of the State and are usually associated with infrequent but very intense rainstorm and streamflood events.
      2. Surface-water activity; flooding, erosion, and sedimentation associated with excessive runoff from both snowmelt and rainstorms in a semiarid to arid region with generally sparse vegetative cover (Schumm, 1977; Wilson, 1973).
         a. Adverse effects of excessive meltwater runoff usually occur in the late spring and are limited to valley floors of river systems that head in high mountain areas (e.g., Rio Grande, San Juan, Pecos, Canadian, and Gila rivers).
         b. Adverse effects of major rainstorms of the June to October period (as well as infrequent intense rains at other times) can occur anywhere in the State. The great river floods of the historical record were caused by these rainfall events. Runoff effects are not confined to valley floors. Erosion, sedimentation, and flood damage can occur on a wide range of slopes, and are particularly severe in urbanized areas where runoff/precipitation ratios approach maximum values.
      3. Eolian activity; wind erosion (deflation) and sedimentation associated with sustained, high-velocity winds, sandy and finer surface-sediment textures, and sparse vegetative cover. Adverse eolian effects are most pronounced during the dry, late winter and spring seasons with strong southwesterly winds.
         Such effects are greatly enhanced where human activity decreases vegetative cover and disturbs surface soil horizons.
         a. Fine-grained aerosols (silt-clay size), usually produced during spring windstorms, can form dust clouds that attain altitudes exceeding 10 km (Hoidale and others, 1967; Gillette, 1976). Adverse impacts of atmospheric dust include severe visibility impairment, abrasion effects, and respiratory problems for a variety of organisms including humans.
         b. Active areas of eolian-sand movement and dune formation usually are located within more extensive stabilized dune fields and sand sheets that became vegetated earlier in the Holocene. These older deposits are located downwind of fluvial and lacustrine plains that were sites of large streams and lakes during late Pleistocene pluvial intervals (Machette, 1978b; Lambert, 1974; Reeves, 1972; Schultz, 1980; Widdicombe, 1980).
      4. Surface subsidence activity; associated with removal of subsurface support due to consolidation, dissolution, or

excavation of earth materials. Human actions related to (liquid and solid) resource extraction can have a major impact on surface subsidence (IIA1).

- a. A major cause of subsidence and associated earth fissures noted in nearby states is differential consolidation of earth materials due to large withdrawals of ground water (or oil and gas) and resultant decreases in hydrostatic pressure (Holzer, 1980; Laney and others, 1978). To date this type of subsidence has been noted in only a few intermontane basins of southwestern New Mexico, but this process will have increasing impact with further ground-water withdrawals from poorly consolidated aquifers (IIA1a).
- b. Solution of Permian evaporites and carbonate rocks is an important natural process that has produced large subsidence basins in the Pecos Valley section of the southern Great Plains province. Relict limestone- and gypsum-karst terranes are extensively preserved. However, at present, the dominant solution-subsidence process is associated with (deep and shallow) dissolution of gypsum and various sodium and potash salts. Several large collapse depressions have formed in the present century (Anderson, this volume; Bachman, 1980).
- c. Surface subsidence associated with excavation of earth materials is a potential hazard in any area of underground mining. Significant subsidence due to mine-roof collapse is an active process in the potash salt-mine area of southeastern New Mexico. Local subsidence effects have also been noted in a number of coal- and metal-mining districts.

C. Geological materials and land-surface forms as part of the surface environment and their relationship to geomorphic processes. Interactions of materials and surface forms with the processes outlined in Part IB illustrate the complex feedback mechanisms that characterize most aspects of environmental geology (III).

1. Controls exerted by earth materials on epigene processes, such as effects of lithology and structure on degree of surface stability, wind and water action, and subsidence. These controls include the following.
    - a. Adverse effects of fine-grained and highly deformed material on slope stability and mass wasting (IB1).
    - b. Susceptibility of unconsolidated, sandy to loamy surficial materials to water and wind erosion (IB2, IB3).
    - c. Adverse effects of fine-grained unconsolidated material within aquifer zones on surface subsidence and earth-fissure formation (IB4a); and solution subsidence (IB4b) due to presence of carbonate rocks or evaporite minerals.
    - d. Adverse effects of expansive clays and salts on surface stability.
2. Controls exerted by land-surface forms on epigene processes include the following.
    - a. Adverse effects of large local relief and steep slopes in terms of mass-wasting and stream-erosion potential (IB1, IB2).
    - b. Susceptibility of gently sloping valley or basin floors to flooding and sedimentation.
    - c. Tendency for broad, gently sloping drainage-divide areas to be stable in terms of erosion and sedimentation.

II. Geological materials and landforms as resources, and their environmental impact with respect to mineral development, intensive land use, and preservation of scientific, scenic, and cultural values. The institutions of modern industrial society are based on mineral and land resources. Concentration of these resources means concentration of human impacts on the environment. Due to their great age, many economic-mineral deposits formed under conditions unrelated to existing geological environments. However, the processes outlined in Topic I, including those with adverse impacts from a short-term perspective (IA2, IB2, IB3), also produce resources of significant value. For example, pumice and scoria produced by violent volcanic eruptions are major sources of lightweight aggregate, and stabilized eolian deposits derived from dust storms form important agricultural soils (IIC2).

A. Geological materials as mineral resources and environmental effects of mineral exploration and extraction (IB4, IIIA2).

1. Production of liquids and gases from wells; includes developing technology in the areas of in-situ mineral and geothermal energy extraction.
    - a. Ground-water development. Adverse impacts include depletion of nonrenewable, high-quality water resources and decline of hydrostatic pressure resulting in earth-material consolidation and surface subsidence (IB4a). Some alluvial basins in southwestern New Mexico have already experienced small amounts of subsidence and earth-fissure formation due to ground-water withdrawals.
    - b. Oil and gas development in Colorado Plateau province and southern Great Plains province; production, injection, and disposal of brines associated with recovery operations are a serious environmental problem in many oil fields (Stephens and Siegel, Wilson, this volume).
    - c. Carbon dioxide production in the Raton section of the Great Plains province.
2. Subsurface production of solid minerals. Large active underground-mining operations in the State produce potassium salts, coal, and metallic ores. Underground mines have historically produced coal, and a variety of metallic ores and industrial minerals. All such operations should be expected to produce some surface subsidence and related collapse depressions and earth fissures.
    - a. Potash and associated evaporite-mineral production; from extensive deep mines located in very sparsely populated areas of southern Pecos Valley section of the Great Plains province.
    - b. Coal development; large active subsurface operations in sparsely populated area of the Raton section west of Raton.
    - c. Uranium ore production; major deep-mine activity in the Grants mineral belt of the Colorado Plateau province. Adverse impacts related to ground-water production as a byproduct of mine development include potential for contamination of this water with toxic substances (Gallaher and Goad, this volume), and downstream effects on fluvial systems due to in-

creased surface discharge. In-situ leaching of uranium ore may be an important uranium mining process in the future. This process creates a large potential for ground-water contamination.

3. Surface production of solid minerals. Large surface-mining operations produce coal, copper, molybdenum and associated metal ores, and uranium ore. Numerous small surface mines and quarries produce a great variety of aggregate materials and industrial minerals, including sand and gravel, crushed rock, perlite, pumice and scoria, gypsum, limestone, clay/shale, and caliche. Surface-mine reclamation requirements and procedures have, or will have, significant impacts both on mining operations and on environmental conditions at and adjacent to mine sites (Wells and Rose, this volume).
   a. Coal surface mining: major ongoing strip-mine activity in the Navajo section of the Colorado Plateau, and west of Raton, with many additional operations planned in the State (Tabet and Frost, 1978). Environmental effects relate to the very large, relatively shallow excavations and to the extensive backfilling and other reclamation procedures required by the Surface Mining Act. Mining to date has primarily affected unsaturated materials in upland areas away from floors of major stream valleys. Adverse impacts primarily relate to disturbance of soils and vegetation, increased runoff, and potential for erosion-sedimentation damage (Wells and Rose, this volume).
   b. Copper, molybdenum, and associated metal ore production. Large open-pit operations, primarily for copper in southwestern New Mexico near Silver City, and for molybdenum in the Sangre de Cristo Mountains east of Questa, are also in areas of major underground mines. Environmental effects relate to the large size and great depth of excavations (to levels below adjacent valley floors east of Silver City). Impact on ground-water conditions may be locally significant, and there is potential for erosion-sedimentation damage and transport of toxic substances related to surface runoff. To date, mine-reclamation procedures, involving backfilling and leveling operations, have not been required in the metal mining districts.
   c. Uranium ore production; surface mining includes one large open-pit operation in the Mount Taylor-Laguna area east of Grants. Adverse impacts mainly involve potential for flood runoff that contains toxic substances and large sediment loads.
   d. Industrial-mineral development including production of aggregate materials. Most surface mining activities are on a small scale, but due to the great number and statewide distribution of operations, they can have significant environmental effects. Sand and gravel pits on river flood plains and terraces are particularly vulnerable to adverse impacts. Post-mining activity commonly involves use of such excavations for urban and industrial waste disposal. Most pits and quarries are very poor sites for disposal of toxic materials (IIIB7b, IIIC4b) (Longmire and others, this volume).

B. Geological materials as scientific or cultural resources that should be preserved in their natural setting (related to IIC1b, IIC3). Of particular importance are fossils, rocks, and minerals that have special significance in terms of earth history, and are best studied and displayed in the context of field relationships.
   1. Fossil-bearing stratigraphic sequences that have significance in terms of the history of life on Earth. Includes Permian reefs of the Guadalupe Mountains west of Carlsbad and fossiliferous Mesozoic and Cenozoic rocks of the Navajo section of the Colorado Plateau province.
   2. Rock sequences and mineral deposits that illustrate geologic processes or important facets of earth history; many of these rock sequences are preserved or recognized in National and State Park systems and in the National Natural Landmarks program of the U.S. Heritage Conservation Recreation Service (HCRS). Includes Carrizozo basalt flow at Valley of Fires State Park, and Harding Mine pegmatite locality north of Santa Fe (Jahns and Ewing, 1977).
   3. Geological materials that form or contain features of special cultural significance. Includes materials of archeological, historical, and religious significance in the context of Native American and Hispanic culture (Love, 1980).

C. Landforms (comprising land-surface forms and associated surficial materials) as natural resources, and environmental impacts related to land use. Emphasis is on nondestructive use of land resources. Geomorphology, the subdivision of geology devoted to landform study, serves as a link between geology and the related disciplines of physical geography, soil science and engineering, hydrology, climatology, and ecology. Aspects of this linkage are illustrated by the following resource categories.
   1. Land-surface form as a resource. Terrain features have inherent resource value where human economic activities are limited to a small range of surface characteristics (e.g., altitude, shape, slope inclination, and aspect) or where surface forms have scenic attributes. Terrain features may also be recreational, cultural, or scientific resources (IIC3).
      a. Terrain as a resource in terms of agriculture and transportation activities. Lands suitable for irrigation agriculture and most railroad routes are limited to broad, undissected surfaces with gentle (< 8 percent) slopes.
      b. Terrain as a scenic or recreational resource. The State has many areas that are either informally or formally used as scenic attractions or recreational resources (e.g., Rio Grande Gorge State Park in the Southern Rocky Mountains province). Most of these areas also contain geologic materials (IIB) and landforms (IIC3) of scientific or cultural value. Intensive recreational land use (e.g., ski resorts, off-road vehicles) of rugged upland terrains can have significant adverse impacts in terms of slope stability, mass wasting, and erosion-sedimentation.
   2. Surficial materials and soils as land resources. They include agricultural soils as well as the upper part of the regolith investigated by geomorphologists, pedologists, and geotechnical engineers. Materials in this class may be genetically related to specific landforms, e.g., surficial deposits of alluvial fans and terraces, flood plains and dunes (Hawley, 1972; Hunt, 1977a, b; 1978a, b).
      a. Surficial materials as (pedogenic) soil parent materials

have been described in considerable detail by pedologists and soil surveyors (Gile and Grossman, 1979; Maker and others, 1974). Pedogenic features in these materials (e.g., horizons of clay and carbonate accumulation) indicate varying degrees of land-surface stability and soil age (Gile and others, 1981; Machette, 1978a).

b. Surficial materials can also be classed in terms of suitability (capability classes) for various types of land uses (e.g., trafficability and irrigability); or they can be rated in terms of engineering limitations (e.g., corrosive, expansive, or sensitive soils).

3. Landforms as scientific or cultural resources that should be preserved (National Park Service, 1972). Comments pertinent to this category are made in sections IIB and IIC1b.

III. Geological contributions to the inventory, planning, and site-selection process (Brown, 1974, p. 5) as part of a statewide environmental geology program. This involves the application of geology to the inventory of natural systems, the formulation of broad guidelines for mitigation or prevention of environmental problems, and the selection of specific areas or sites for human activities in order to minimize adverse interactions with the environment. This application of the broad range of geological sciences (including engineering geology, geomorphology, hydrogeology, stratigraphy and sedimentation, petrology, geochemistry, and geophysics) is environmental geology, and it is primarily geology for public consumption. Clear presentation of scientific information to a general audience is required. Effective communication of geologic interpretations is probably the most difficult part of the inventory and planning process.

A. Application of geology to the inventory of natural systems with impacts on human affairs; primarily the evaluation of geomorphic processes, and mineral and land resources outlined in Topics I and II.

1. Geomorphic process inventory. A major task of the environmental geologist is to put geomorphic processes and their impacts on human affairs into proper time and space perspective (four-dimensional relationships of Brown, 1974, fig. 1). Thorough understanding of process rates and recurrence intervals requires study of relatively recent geologic history and Quaternary stratigraphy (Hawley and others, 1976), as well as measurement of dynamic elements (Rhodes and Williams, 1979; Wilson, 1968) of the modern geomorphic system.

a. Inventory of deep-seated (hypogene) processes (IA); includes input of structural geology, stratigraphy, and geophysics in order to most properly assess impacts of tectonic and volcanic processes, and related seismic and geothermal activity, structures, materials, and landforms (Hawley, 1978; Machette, 1978a; Riecker, 1979; Gibbons and others, this volume).

b. Inventory of surficial (epigene) processes (IB); includes input of Quaternary stratigraphy and sedimentation, quantitative and dynamic geomorphology, and pedology in order to place relict and dynamic processes (and their products) in proper perspective (Machette, 1978a, b; Love, 1980; Schultz, 1980; Gile and others, 1981; Wells and Gutierrez, 1981; Lagasse, and Wells and Rose, this volume). Major process categories with significant statewide environmental impacts include mass-wasting, surface-water (fluvial), eolian, and ground-water systems.

2. Earth-material and landform resource inventories. These resource evaluations include the basic tasks of mapping and laboratory study that most geologists perform on a routine basis. Emphasis is on characterization of resource categories listed in Topic II, including not only nonrenewable mineral resources, but also land, water, scientific, recreational, and cultural resources. State agencies preparing geological and hydrological resource inventories include the Bureau of Mines and Mineral Resources (Kottlowski and staff, 1980), Energy and Minerals Department (Arnold and Hill, 1980; New Mexico Bureau of Mine Inspection, 1980), State Highway Department (Lovelace, 1972), and Water Resources Division (Reynolds, 1980). The Federal agencies that are involved in resource inventory include the Geological Survey, Bureau of Land Management, Water Power and Resources Service, and Soil Conservation Service.

a. Inventory of liquid and gas mineral resources (IIA1) (Foster and Grant, 1974; Stone and others, 1981).

b. Inventory of solid mineral resources (IIA2, IIA3) (Sheffer and Eveleth, 1979).

c. Inventory of geologic materials of scientific or cultural value (IIB).

d. Inventory of landforms and surficial deposits that are important resources in terms of a variety of land uses (including urban, agricultural, transportation, recreational, and military activity) or because of scenic, scientific and cultural values (IIC) (Hunt, 1977a, b, 1978a, b; Lovelace and others, 1972; Maker and others, 1974).

B. Application of geology to planning for mitigation or prevention of environmental problems. Examples of problems addressed include protection of people and property from impact of geologic hazards, promotion of responsible development and conservation of mineral resources, or implementation of a mandate to develop criteria for selection of waste-disposal sites. The geologist must apply all available information (IIIA) to the planning problem at hand, making sure that this information is incorporated into the guidelines formulated. The following topics indicate the broad range of problems that can be addressed in the planning process.

1. Planning for mitigation or prevention of geologic hazards (U.S. Department of the Interior, 1977).

2. Planning for responsible mineral resource development and conservation, including mitigation of adverse effects of mineral exploration, extraction, and processing; and resolution of conflicts (economic, legal, cultural) between mineral development and other land uses. Examples of current efforts include inventories of abandoned-mine lands needing remedial-treatment measures and land resources affected by proposed coal-surface mining (e.g., alluvial-valley floors and prime farmland).

a. Mineral exploration; includes planning to mitigate effects of exploration drilling programs.

b. Mineral extraction from wells and underground mines. Surface-subsidence effects (IB4g, IB4c) need to be inventoried as an initial step in the planning process.

c. Mineral extraction from surface mines. The Surface Mining Act of 1977 (and the State law and regulations based on this act) are an example of the planning process carried to an extreme level in order to mitigate the environmental impacts of coal mining.

   d. Mineral processing; includes planning for prevention of tailings spillage, e.g., United Nuclear Church Rock 1979 tailings spill (see Callaher and Goad, this volume).

3. Planning for preservation of scientific, scenic, and cultural resources that are related to geology (IIB, IIC3).
4. Planning for intensive land use in urban, industrial, and recreational areas. With the exception of State Highway Department assistance to Albuquerque, there has been little or no formal activity in terms of urban geology in New Mexico.
5. Planning for regional electric power and water projects, oil and gas pipelines, and vehicular transportation systems. Extensive environmental impact studies are prepared for all such projects by the industries and agencies involved (e.g., Public Service Company of New Mexico, El Paso Natural Gas Company, Interstate Stream Commission, U.S. Water Power and Resources Service, State Highway Department, and U.S. Bureau of Public Roads).
6. Planning for large-area land use in regions where population density is low.
   a. Soil and water conservation planning for farm and range lands; includes designation of lands suitable for irrigation by the U.S. Soil Conservation Service in cooperation with the New Mexico State Agricultural Experiment Station (Anderson and Maker, 1974).
   b. Planning for scientific research projects; includes planning for the National Radio Astronomy Observatory's Very Large Array radio telescope facility near Datil, the National Aeronautics and Space Administration's Manned Spacecraft Test Facility near Las Cruces, and several large experimental range and watershed projects operated by the U.S. Department of Agriculture and New Mexico State University.
   c. Planning for military defense activities, including the White Sands Missile Range, the Fort Bliss-McGregor Range, and the proposed MX missile operation on the High Plains of eastern New Mexico.
   d. Planning for recreational use in sparsely populated areas, e.g., near Gila and Pecos wilderness areas.
7. Planning for hazardous-waste storage and disposal. The enormous quantities of mine spoil and mill tailings produced by potash and metal extraction operations pose a special class of disposal and storage problems. One major problem involves uranium mill tailings (Dreesen, 1978); and considerable remedial action will have to be taken to remedy present hazardous conditions. Another planning activity concerns proper location of sites for waste reprocessing or incineration. Such options should be considered before permanent burial is contemplated.
   a. Most planning for radioactive-waste storage and disposal has been at the Federal level (National Research Council/National Academy of Science, 1976, 1978), and there has been a major effort in the past 2 years to formulate final criteria for geologic disposal of nuclear wastes within the Department of Energy's National Waste Terminal Storage Program (Office of Nuclear Waste Isolation, 1980). Site specific work in New Mexico is mentioned in section IIIC4a.
   b. State planning for geologic disposal of hazardous (nonradioactive) wastes began in 1977 (Foster and others, 1977); however, no firm siting criteria were established or tested on a statewide basis. Current efforts at guideline formulation by staff members of the State Environmental Improvement Division and Bureau of Mines are discussed by Longmire and others (this volume).

C. Application of geology to selection of specific project areas or sites to minimize adverse interactions of human activities and the environment. Ideally, site selection follows inventory (IIIA) and planning (IIIB) studies. However, in practice, many locations are selected without careful consideration of environmental concerns; and geologists and other specialists must then show that a site really is suitable for a proposed operation, monitor adverse impacts of an existing or former operation, or recommend "after the fact" mitigation procedures.

1. Site selection for industrial activity or public works projects with potential for adverse environmental impacts on large geographical areas. These projects (e.g., dams, power plants, smelters, and refineries) have traditionally used engineering geology during design and construction phases; and in recent years much effort has been made on assessment of long-term impacts.
   a. Dam, reservoirs, and related water-conveyance systems. Large structures in the State have been built by the Army Corps of Engineers and the Bureau of Reclamation (now U.S. Water Power and Resources Service). Recent site-specific activities include those related to construction or proposed construction of large dams at Cochiti on the Rio Grande, near Carlsbad and Santa Rosa on the Pecos, and on the lower Rio Puerco north of Socorro. The Soil Conservation Service has conducted many geological studies at sites for smaller flood and sediment control structures on major arroyo systems.
   b. Power plants; mineral refining, milling and smelting; and other heavy-industry facilities. Recent site-specific activities include those related to construction of a coal-fired power plant west of Farmington and a copper-ore processing facility southeast of Lordsburg.
2. Route selection for conveyance, transmission, and transportation systems.
   a. Pipeline (oil, gas, and water) and powerline routes result in disturbance of surficial materials in shallow trenches and holes (up to 4 m), and there is usually no need for much additional earth material for construction operations. However, impacts on scenic, scientific, and cultural resources need to be considered.
   b. Canals (irrigation-water conveyance) and vehicular transportation routes may require use of large amounts of aggregate materials in their construction and thus can have major environmental impacts. State Highway Department engineering geology studies in the past 25 years have been devoted to route selection and aggregate resource development for the Interstate Highway System.
3. Selection of areas for scientific research or military defense operations. Specific sites include those related to operations of the National Radio Astronomy Observa-

tory (Very Large Array radio telescope) east of Datil, Los Alamos National Laboratory, Sandia Laboratories, White Sands Missile Range, and a number of military posts in the State. Except for radio astronomy, there are many security restrictions on availability of information. However, all such operations utilize geologists, hydrologists, and geotechnical engineers in site-specific investigations.

4. Site selection for hazardous-waste storage and disposal. At present (January, 1981), there are no sites authorized for disposal of hazardous wastes in the State. Materials are usually stored on the premises of the waste-generating facility (e.g., private industry, farm, ranch, or public institution), or they are shipped out of the State to some licensed disposal site. An unknown amount of toxic material is dumped illegally (New Mexico Environmental Improvement Division, 1980).
    a. Radioactive waste. One study has been conducted at a proposed (commercially operated) site for disposal of low-level waste in a land-fill operation south of Raton (Herkenhoff, G. and Associates, Inc. and Summers, W. K. and Associates, 1977). Another site-specific activity primarily concerned with low-level wastes involves ongoing operation of disposal trenches at Los Alamos (Rogers, 1977). By far the largest siting activity is the Department of Energy's proposed Waste Isolation Pilot Plant (WIPP) for deep disposal of nuclear wastes generated by the Department of Defense. Various geological and hydrological aspects of this project are discussed in this volume by Anderson, and Brookins, and Mercer and Gonzalez, and Powers, as well as in recent reports by Bachman (1980) and the Environmental Evaluation Group (1980) of the State Health and Environment Department.
    b. Hazardous (nonradioactive) wastes. As noted in section IIIB7a, there has been no selection of, or geotechnical investigations at, a specific site for hazardous-waste disposal. However, several corporations with regional or national waste-disposal operations are evaluating a number of localities suggested for consideration by Foster and others (1977). Significant progress in this major area of environmental concern awaits formulation of sound guidelines for waste disposal that apply to conditions in the southwestern United States (Longmire and others, this volume).
5. Site selection for recreational use. Certain areas are more suitable for recreational activity (e.g., off-road vehicular activity). Geologists should participate in the selection of those areas where recreational activity will not pose environmental problems.

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AN OVERVIEW OF HYDROLOGY AND ENVIRONMENTAL CONCERNS IN NEW MEXICO

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ABSTRACT

The hydrology of New Mexico has been extensively modified by natural and artificial causes and is continuing to change. New Mexico receives a total of about 1.05×10^5 cubic hectometers of precipitation annually; 4,000 cubic hectometers of water appear as runoff in streams. Proposed methods of increasing the supply of water for increasing municipal and industrial use include vegetative management, increased ground-water pumping, decreasing evaporation from reservoirs, and improving irrigation efficiency. Each of these methods will have associated hydrologic and environmental impacts. In many cases our present knowledge is inadequate to predict the effects of these changes with a high degree of accuracy.

INTRODUCTION

A broad overview of hydrology and the environment in New Mexico needs to include the realization that what we view today as the hydrology of the State is the result of many natural and manmade changes about which we have very little information. The earliest, nearly continuous, precipitation record in the State began in 1850 at Santa Fe. Daily measurements of stream discharges were begun at the Embudo gage on the Rio Grande in 1889, and measurements of water quality on the Rio Grande and Pecos River were begun in 1905. With such a short "baseline," and with the large variability in flow and water-quality characteristics, only rapid, localized, quantitatively large effects are easily observed. In the case of small effects, which may be important cumulatively or environmental impacts which may be slow to appear in surface-water systems, an understanding of the mechanisms affecting the hydrology is needed to assess past and future impacts of human activities on the hydrologic environment. Such an understanding exists in only limited areas of hydrology while potential impacts exist in every segment of the hydrologic cycle.

In attempting to secure more water for projected increases in industrial and municipal use, while retaining the present irrigation uses, methods of managing water resources have been proposed which affect every component of the hydrologic cycle. The following discussion gives the magnitude of each component, some past and present effects of human activities, and additional management methods which have been proposed.

PRECIPITATION

New Mexico receives an average of about one-third meter of precipitation, or a total of 1.05×10^5 hm^3 (cubic hectometers) of water annually. This precipitation contains minor dissolved constituents derived from dust and atmospheric gases. The existing data on the quality of precipitation, however, are few and recent. We can infer that the carbon dioxide concentration in rainfall has increased as the global carbon dioxide balance has changed. Rainfall quality also may change as a result of the increasing numbers of coal-fired power plants being built in the State. "Acid rain" is a recently recognized phenomenon of the industrial northeastern U.S. Acid rain is not likely to produce problems in New Mexico as serious as those in the northeastern U.S., but the long-term effects of variations in the quality of rainfall have not yet been studied.

It has been proposed that water supplies could be augmented by "cloudseeding." This method, however, is still controversial. The Second National Water Assessment (U.S. Water Resources Council, 1978, p. 22) states that ". . . seeding of winter storms in local areas of the West has increased total precipitation from 5 to 25 percent." The New Mexico Water Assessment for Planning Purposes (U.S. Bureau of Reclamation and State of New Mexico, 1976, p. 168) indicates that there has not been conclusive proof that streamflow can be augmented by cloud seeding, and that there may be ". . . insuperable problems related to social impact, the law, and the environment."

RUNOFF

About 4,000 hm^3 per year of the estimated 1.05×10^5 hm^3 of precipitation is direct runoff to streams. Most of the remainder is evaporated or transpired by plants, or infiltrates to the ground-water system (U.S. Bureau of Reclamation and State of New Mexico, 1976, p. 12). Thus, less than 4 percent of the precipitation in New Mexico is available for use from streams. Of this amount, about 1,200 hm^3 is estimated to be transpired by streamside vegetation.

One method of making additional water available from streams is contained in the "vegetative management alternative" (U.S. Bureau of Reclamation and State of New Mexico, 1976, p. 164). This concept contains a provision for increasing runoff from forest lands through modified timber-harvest practices and brush control. Present studies are not adequate to predict changes in stream-water quality, particularly suspended sediment yield, as a result of harvesting timber to increase runoff.

INFILTRATION AND GROUND-WATER SYSTEMS

The quantities of water infiltrating to or discharging from ground-water systems each year are not well known. The base flow of the upper reaches of many streams is supplied by ground-water discharge. While the discharge from large spring areas, such as Major Johnson Springs on the Pecos River, are easily recognized, the flow systems contributing to them are not always well known. The quantities of water infiltrating or discharging from ground-water systems are usually small when compared with the total quantities of water in the aquifer at any one time. About 2.5×10^7 hm^3 of water is estimated to be present in aquifers underlying New Mexico, with about one-quarter being fresh or slightly saline. The quantity of fresh and slightly saline ground water is therefore equivalent to more than 6,000 years' surface-water supply.

An alternative that would increase the short-term water supply would be to pump water from deep wells in the alluvial fill in the Rio Grande Valley. Lowering water levels in the alluvium will decrease the flow in the Rio Grande. Large quantities of water will be derived from storage in the alluvial fill, however, and part of the water could be returned to the Rio Grande, or to a lined channel, to meet downstream commitments. Eventually, the effects on the Rio Grande would approach either the amount of water pumped from the wells or the maximum rate at which streamflow would infiltrate the bed of the river. A large quantity of water could be made available for many years by this technique. The environmental effects of this practice could include destruction of streamside vegetation, unless supported by irrigation, and possible land-surface subsidence as water is forced out of clay layers in the alluvial fill.

WATER USE

It is estimated that about 1,200 of the 4,000 hm^3 of runoff generated in New Mexico is consumed by streamside vegetation. The remaining water is used to irrigate about one-half of the 11,000 km^2 of cropland in the State and provide for various municipal and industrial uses. When ground-water depletions are included, it is estimated that approximately 2,700 hm^3 of water were consumed in New Mexico in 1970 (U.S. Bureau of Reclamation and State of New Mexico, 1976, p. 149). Irrigated agriculture accounted for 77 percent of these depletions, and another 13 percent were by evaporation from lakes, reservoirs, and playas. An article in New Mexico Business Magazine (Governor's Council of Economic Advisors, 1977, p. 8) pointed out that rural and irrigation uses comprised 93.3 percent of the depletions in 1970, while urban, industrial, minerals, and manufacturing uses together comprised only 6.7 percent.

Decreasing the use of water by irrigated agriculture in New Mexico by 10 percent would therefore more than double the water available for municipal and industrial use. Some of this water could be made available without loss of agricultural revenues through increasing irrigation efficiency. Methods such as mulching with plastic, drip or trickle irrigation, and efficient irrigation schedules certainly reduce the amount of irrigation water diverted. The amount by which irrigation depletions are reduced is smaller, however, and depends on how much evaporation losses and non-beneficial consumptive use are reduced. It is necessary to know how much water infiltrates to the ground-water system with various irrigation methods because reducing diversions in an amount equal to the reduction in infiltration to the ground-water system saves energy, not water. Studies at New Mexico Institute of Mining and Technology and New Mexico State University are addressing this problem, but methods are needed to apply these studies statewide.

EVAPORATION AND TRANSPIRATION

Environmental changes, induced by human beings, having an effect on hydrology include the introduction of exotic plant and animal species as well as such obvious effects as damming and diverting streams or pumping ground water. Saltcedar, for example, was first reported growing in Mesilla Park in 1910 and covered about 500 km^2 in the drainage basins of the Rio Grande and Pecos River by 1972. These plants are responsible for part of the approximately 1,600 hm^3 of water consumed annually by riverside vegetation or evaporated from stream channels in New Mexico. The U.S. Water and Power Resources Service (formerly the U.S. Bureau of Reclamation) has been conducting a program of phreatophyte control on the Pecos River between Acme and Artesia since 1967. Although studies are still in progress, the expected 25 hm^3 of salvaged water has not appeared as a base-flow increase in the Pecos River. One possible explanation is that the initial transpiration from mature saltcedar was overestimated, and the expected evapotranspiration from bare ground and replacement vegetation after saltcedar removal was underestimated (G. E. Welder, oral commun., 1980). Whether or not significant amounts of water are made available through phreatophyte clearing, the technique will remain controversial because of saltcedar's role as a wildlife habitat.

The 13 percent of annual water depletions attributed to reservoir evaporation seem an obvious target for saving water. Numerous experiments have been conducted to suppress reservoir evaporation by applying monomolecular films. The Westwide study (U.S. Bureau of Reclamation, 1975, p. 16), however, notes ". . . research to date has not been able to solve the problem of wind destruction of the evaporation inhibitive film layer. Water saving by this method would be economical only in areas where water costs are quite high." The Water Resources Assessment (U.S. Bureau of Reclamation and State of New Mexico, 1976, p. 166) indicates that a reduction in dissolved oxygen and increase in temperature might be the results of a successful evaporation-suppression program.

SURFACE-WATER QUALITY

The New Mexico Water Quality Control Commission (1980, p. 2) indicates that for 1974-79, the water quality in more than 90 percent of the 5,600 km of perennial streams covered by water-quality standards was acceptable. Violations of the standards occurred in about 480 km of perennial streams and were primarily related to municipal wastewater and mining-industrial discharges.

Salinity in New Mexico streams increases downstream through the addition of salt (salt loading) from natural and artificial sources and the concentration of salt by evaporation. The New Mexico Water Quality Control Commission (1980, p. 22) estimates that human activities (irrigation and reservoir storage) and natural addition of salt in runoff or as ground-water discharge are of about equal importance in increasing salt concentration. Natural sources account for more than two-thirds of the salt loading.

Irrigation that has been in progress for an extended period of time generally returns as much salt to the river or ground-water system as was diverted, in a more concentrated solution. Areas that have recently been placed under irrigation, particularly in areas of saline soils, may contribute additional salt loading to nearby streams. The full development of the Navajo Indian Irrigation Project on the San Juan River, for example, may contribute about 8×10^{-3} metric tons of dissolved solids per square kilometer as estimated in a U.S. Water and Power Resources Service salinity model. This value is, however, a rough estimate for the entire Colorado River system, and the maximum increase in salt loading in this reach could be much larger.

Mining, milling, and power-generation activities, because they frequently use water in transporting or processing ore, waste rock, or ash with a content of soluble salts, have the potential of increasing the salt-loading of nearby streams. Estimates of the discharge (seepage and surface-water releases) from the Four Corners and San Juan powerplants and associated facilities, for example, indicate that the salt load in the return flow is approximately 50 percent greater than the salt load in the water diverted (K. Ong, oral commun., 1980).

Because natural sources account for more than two-thirds of the salt load of rivers statewide, it should be possible to divert excessively concentrated point sources and improve water quality in some stream reaches. Salt springs along the Malaga Bend reach of the Pecos River discharge saturated brines to the river, severely degrading the water quality. An experiment to decrease this brine discharge by pumping from the brine aquifer was begun by the U.S. Water and Power Resources Service in July 1963 and continued until May 1976. Brine pumped from the well was piped to a closed depression and evaporated to salt. In February 1978, the depression contained about 0.5 hm^3 of salt. In order to entirely stop the discharge of springs, it was necessary to pump the well in excess of the natural discharge of the springs. Because the depression in which the brine was discharged leaked, and this leakage returned to the river through the shallow ground-water system, the water quality in the river actually deteriorated after an initial period of improvement. It does appear to be possible, however, to improve the quality of the river, if a suitable depression in which to store the brine can be found (Kunkler, 1980).

Suspended-sediment loads vary widely for New Mexico streams, with some streams such as the Rio Puerco and Rio Salado producing sediment in excess of 2×10^{-4} hm^3 per year per km^2. Whereas New Mexico's 11,000 km^2 of cropland comprise less than 4 percent of the area of the State, more than 80 percent of the State is classed as grazing land. The potential impact of grazing on hydrology is therefore quite large, both in terms of direct reduction of vegetation density and in terms of changing species distributions as a result of grazing. The New Mexico Water Quality Control Commission (1980, p. 21), points out that grazing and road construction are significant contributors to large sediment loads in many streams.

GROUND-WATER QUALITY

Environmental concern over the quality of ground water is widespread. Subsequent papers in this symposium (see Wilson, Gallaher and Goad, Longmire and others, this volume) reflect the concern with radioactive-isotope transport in ground-water systems. Another concern is the possible inter-aquifer flow induced by underground mining. Kelly and others (1980) describe possible migration of water containing excessive sulfate concentrations between aquifers in the Ambrosia Lake mining district, as a result of uranium-mine dewatering. The effects of mine abandonment on ground-water systems are not well known.

The New Mexico Water Quality Commission (1980) identifies five major sources of possible ground-water contamination: Saline-water intrusion, mine dewatering, tailings and spoil piles, brine disposal, and liquid-waste-disposal systems. Saline-water intrusions have been noted in the Roswell Basin and are possible in the Estancia and Tularosa Basins. The effluent from mines commonly contains anomolous concentrations of uranium, vanadium, selenium, molybdenum, sulfates, iron, and dissolved solids. Tailings ponds in New Mexico receive discharges from uranium, molybdenum, copper, and potash refining operations. Oil-field brines are currently disposed of by reinjection; however, brines were released to unlined pits until the early 1960's. Leakage from these pits has contaminated ground water in local areas. Liquid-waste-disposal systems including septic tanks and cesspools return water containing excessive concentrations of nitrate and dissolved solids to the ground-water system.

CONCLUSIONS

The hydrology of New Mexico cannot be viewed as an isolated static condition from which we can measure changes resulting from environmental impacts. New Mexico's environment has been "managed" for the benefit of the inhabitants since the first Pueblo Indians moved into the area. Our data base of less than 130 years permits us to view the results of recent changes in these management practices as combined with natural variations and artificial regional or global changes. We need to continue to improve our understanding of hydrologic mechanisms if we are to understand and measure the consequences of artificial environmental modifications.

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OVERVIEW OF ENERGY RESOURCES IN NEW MEXICO

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Citizen: "Beloved Rabbi, is there a proper blessing for the Czar?"

Rabbi: "A blessing for the Czar? Of course. 'May God bless and keep the Czar . . . far away from us!'"

—"Fiddler on the Roof," 1964

INTRODUCTION

Headlines and articles in Albuquerque newspapers some 25 years ago proclaimed the advantages to New Mexico's economy of the energy boom taking place in the San Juan Basin. This was the period of the most rapid development of the basin's Mesaverde and Dakota gas and oil fields and the inception of underground mining at the recently discovered Ambrosia Lake uranium deposits—soon to be considered the most extensive and prolific uranium deposits in the world. Interest in the energy boom was so keen that the State's largest newspaper devoted full pages daily and special sections weekly to energy developments.

The State's crude oil was selling for $2.72 a barrel in 1955. Total production that year was 82.4 million barrels worth $224.2 million. The 520 million Mcf (thousand cubic feet) (1.5×10^{10} m^3) of gas produced sold for $45.5 million, or almost 9 cents per Mcf (28.3 m^3). The State's coal industry, which in 1918 employed 4,500 people or almost 1.5 percent of New Mexico's population during World War I, was capable of extracting less than 200,000 short tons (1.8×10^5 metric tons) valued at about $1 million in 1955. Uranium production in 1955 was 2 million pounds (9.1×10^5 kg) of U_3O_8 that was sold to a single purchaser, the Atomic Energy Commission, for $22.5 million. There was no geothermal, solar, or synthetic fuels industry in 1955. Although energy-related activities were becoming a significant part of the State's economy, their contribution then was relatively small. Severance taxes collected from all mineral activity, for instance, were only $7.1 million.

Things have changed! In 1980 the gross receipts from the sale of 74.9 million barrels of New Mexico crude oil were $1.7 billion at a little over $23 a barrel. Natural gas brought $2.0 billion on sales of 1.13 billion Mcf (3.2×10^{10} m^3) at an average of $1.75 per Mcf (28.3 m^3). The coal renaissance that began in 1962 with the opening of large strip mines to furnish the fuel for the 2,085 MWe (megawatt) Four Corners Power Plant supplied 14.6 million short tons (1.32×10^7 metric tons) in 1979, valued at $188 million or $12.88 an average short ton ($14.24 per metric ton). New Mexico's uranium industry had its best year in 1979, producing 17.9 million pounds (8.11×10^6 kg) of yellowcake that were sold for an average of $26.54 a pound ($58.60 per kg) or a total of $475 million. Union Oil Company of California, Public Service Company of New Mexico, and the U.S. Department of Energy are currently joint venturing a $154 milliun geothermal electric plant in the Jemez Mountains; the State has captured a significant part of the research, development, manufacturing, and demonstration of an emerging solar industry; and massive synthetic fuel developments are imminent. Energy-oriented activities currently contribute almost half of the State's revenues and gross annual product. Severance taxes alone on the energy industry will add $200 million to the State's Severance Tax Permanent Fund in 1981.

RESOURCES

Energy

A study by Chase Bank in 1980 found that New Mexico produces 338 percent of its energy needs, second only to Louisiana in terms of energy self-sufficiency. The State ranks fourth in the nation in natural gas production and fourth in extraction of natural gas liquids. The State is seventh in crude oil and lease condensate production. It has 55 percent of the country's uranium reserves and is first in production of this crucial alternate fuel. Over 120 billion short tons (1.09×10^{11} metric tons) of coal lie between the surface and 3,000 ft (914 m) in the State, witn 3 to 6 billion short tons (2.7 to 5.4×10^9 metric tons) of desirable, low-sulfur coal available for relatively inexpensive strip mining. The U.S. Geological Survey (USGS) estimates that the Valles Caldera of the Jemez Mountains alone contains geothermal fluids capable of sustaining 2,700 MWe of electrical generating capacity for thirty years—almost as much by itself as the combined capacity of the San Juan and Four Corners coal-fired generating plants. The only areas in the world receiving more energy from the sun in a year are northern Africa, central Saudi Arabia, southwestern Iran, and central Australia—and none of these exceed New Mexico's solar exposure (insolation) by more than 10 percent!

In attempting to arrive at a common statistical base for energy fuels, engineers and economists have found it necessary to express a given volume of resource in terms of its heat value. As a result it is common to see fuels expressed in terms of Btu, Quads, Therms, BOE, etc., instead of the more easily identified barrels, tons, cubic feet and pounds. It is convenient to know that a British Thermal Unit (Btu) is the amount of heat required to raise a pound of water one degree fahrenheit; a Quad is one quadrillion (1 followed by 15 zeros, or 10^{15}) Btu; a Therm is 100,000 Btu and there are about 10 Therms in one Mcf of natural gas; and BOE means barrels of oil equivalent (another fuel expressed in terms of oil equivalency based upon Btu).

Table 1 presents conversion factors useful in translating "energy language" and manipulating energy statistics. Table 2 shows New Mexico's conventional fuel resources and compares them with the United States base. Columns 5 and 6 of Table 2 convert these resources to Quads of energy and barrels of oil equivalent. The State's 186 Quads can be compared to the approximately 76-78 Quads of energy consumed by the United States on an annual basis. New Mexico's 33 billion BOE exceeds the nation's known supply of 30.6 billion barrels of recoverable liquid crude oil. If this enormous asset could be sold on a Btu basis comparable to the $40 per barrel that deregulated crude oil receives, it would represent a wholesale value exceeding $1.3 trillion.

Water

No analysis of energy resources would be complete without examining water availabilities, commitments, and potentials. As people in many areas of the United States have learned, without adequate and assured water supplies there can be no development. In this context, perhaps the best kept secret in New Mexico is the immense underground water supply available to the State.

New Mexico is somewhat of a paradox with regard to water. Many economists and planners indicate that the State's water re-

Table 1. Energy fuel conversion factors (Grant, 1977).

1 Quad (1,000,000,000,000,000 or 10^{15} Btu) =

178 million barrels of oil
43.9 million tons eastern coal
55.6 million tons western coal
45.0 million tons averaged coal
979.4 million Mcf natural gas
15.6 million pounds U_3O_8 (yellowcake)

Volume

1 barrel (bbl) = 42 U.S. gallons
1 ton = 2,000 pounds (lb)
1 Mcf = 1,000 cubic feet (ft^3)

To use conversion factors: multiply number of Quads (including fractions) times factor to obtain fuel volumes in millions of fuel units. Divide barrels of oil equivalent by appropriate fuel unit factors. If BOE is expressed in BOE/D (barrels of oil equivalent per day), multiply answer by 365 for annual volume.

Fuel unit	=	*millions of Btu*	=	*barrels of oil equivalent*
1 bbl domestic crude oil		5.6		1.0
1 bbl petroleum products		5.5		0.9821
1 bbl residual fuel oil		6.287		1.1227
1 bbl liquified gas (propane, butane, etc.)		4.011		0.7163
1 ton eastern bituminous coal		22.8		4.0714
1 ton western subbituminous coal		18.0		3.2143
1 ton Texas lignite		14.0		2.5
1 Mcf (1,000 cubic feet) dry natural gas		1.021		0.1823
1 pound U_3O_8*		64.0		11.4286

*Btu content of U_3O_8 may range from 50-180 million Btu/lb for light water, low thermal reactors.

sources are fully developed, suggesting constraints on additional municipal, industrial, or energy-related activities. Geological evidence indicates that this resource condition is not so. Distribution of vast underground-water resources is inequitable and uneven in the State, but there is no question that much of New Mexico, including most of the population centers along the Rio Grande, has a virtually inexhaustible supply of fresh ground water. It is extremely important that the citizens of New Mexico understand what their water restraints and opportunities are in order to judiciously examine options available to them in water use.

Information concerning the water supply of New Mexico's largest city, Albuquerque, should be addressed. We in New Mexico have an unfortunate tendency to relate our water supply to what we can see flowing down the Rio Grande, which is often nothing. Like energy resources, it may be more appropriate to examine the water supply in the Rio Grande Valley in terms of production and reserves. Unlike fossil energy reserves, water in our region is replenishable. Albuquerque is situated on a vast underground supply of producible water.

The valley fill in that part of the Rio Grande depression between Española on the north and Socorro on the south, consists mainly of relatively unconsolidated, geologically young deposits eroded from the adjacent mountains. This region is about 5,000 mi^2 (1.3×10^4 km^2) in extent (3,200,000 acres) (1.3×10^6 ha [hectares]), and averages about 4,000 ft (1,219 m) in thickness. Thickness of the water-saturated aquifer underlying the city of Albuquerque is estimated at a minimum of 12,000 ft (3,658 m) based upon deep exploratory oil tests drilled nearby in the basin. The USGS estimates the volume of recoverable fresh ground water in storage in the Albuquerque area is 2.3 billion acre-ft (2.8×10^{12} m^3). An additional half billion acre-ft (0.6×10^{12} m^3) of recoverable slightly saline (less than 3 g/l [grams per liter]) water is also present for a total of 2.8 billion acre-ft (3.5×10^{12} m^3). This is roughly equivalent to about 70 percent of all the water in Lake Michigan. It does not include tremendous volumes of water lying at depths generally below 3,500 ft (1,067 m) in the valley which contain more than 3 g/l salinity.

This resource constitutes one of the most unique and extensive fresh water supplies available to any metropolitan area in the southwestern United States. Albuquerque is not dependent upon surface flow and reservoir storage of water nor does the city rely on a thin, water-filled, confined sand or limestone aquifer at depth. It is literally sited on a subsurface reservoir of 2.8 billion acre-ft (3.5×10^{12} m^3) of recoverable fresh water.

In perspective, one acre-foot (1,233 m^3) of water is what it takes to cover 43,560 ft^2 with 12 inches of water, and is equivalent to 325,851 gal (gallons). In 1979 the City of Albuquerque pumped from its deep wells 28,212,620,000 gal or 86,581 acre-ft (1.1×10^8 m^3) of water for its 329,000 citizens, a miniscule portion of the total supply. About half of this was recycled back to the reservoir and the balance was replaced during spring and summer with snowmelt and rainfall.

Assume for a minute that Albuquerque alone used the water in this basin, and that there were no more rain, snow, or stream flow to keep the reservoir full. At the present rate of consumption it would take 32,474 years to lower the water table 3,500 ft (1,067 m) of the 5,000 to 12,000 ft (1,524 to 3,658 m) we know is there. Obviously, there are other users besides Albuquerque, and the basin will continue to replenish itself. But it does serve to illustrate the strategic economic advantage Albuquerque has that other cities don't with regard to water.

Lowering the water table near Albuquerque by any significant amount is no immediate threat. In addition to the virtually limitless underground supply, the city owns an annual quota of 48,200 acre-ft (5.9×10^7 m^3) of surface water purchased from the San Juan-Chama diversion project. Tunnels beneath the Continental Divide divert 110,000 acre-ft (1.4×10^8 m^3) a year from the San Juan River (Upper Colorado River System) to the Chama and Rio Grande. In 1979 allotments from this source to Albuquerque were 17,700 acre-ft (2.2×10^7 m^3). The full amount will be available in 1982. The city's major problem with regard to this water is not how to use it, since estimates are that it will be at least 20 years before its consumption becomes necessary, but how to store it. The Corps of Engineers has initiated a study to increase the storage capacity of the Abiquiu Dam reservoir to 400,000 acre-ft (4.9×10^8 m^3) to accommodate this surplus water.

People

Not least in terms of natural resources is the tremendous concentration of scientific and technical personnel in New Mexico,

Table 2. New Mexico conventional fuel resources compared to U.S. reserves.

1. *Fuel*	2. *U.S. Reserves*	3. *New Mexico Reserves*	4. *Percent New Mexico of U.S. Total*	5. *New Mexico Quads of Energy*	6. *New Mexico BOE (in billion barrels)*
Coal (strippable, low-sulfur, subbituminous, bituminous)	63.5 billion tons	5.9 billion tons	9.3	107.9	18.96
Uranium (U_3O_8, $50 reserves)	1,872 million pounds	897.4 million pounds	47.9	57.53	10.256
Oil (including oil recoverable by enhanced recovery methods)	30,621.3 million barrels	786.44 million barrels	2.6	4.42	0.786
Natural Gas Liquids	5,655.3 million barrels	439.25 million barrels	7.8	2.47	0.439
Natural Gas	194,916.6 million Mcf	13,460.7 million Mcf	6.9	13.74	2.505
				186.06 (total)	32.946 (total)

Source: Data from various sources including Oil & Gas Journal, v. 78, no. 19, May 12, 1980, p. 80-89 (oil, gas, natural gas liquids); U.S. Bureau of Mines Information Circular 8678, 1975, p. 5-15, and other data (coal); U.S. Department of Energy, Statistical Data of the Uranium Industry, GJO-100(80), 1980, p. 47 (uranium).

together with a work force whose productivity ranks among the highest in the nation. The national research laboratories at Sandia, Los Alamos, and White Sands; the State energy institutes at New Mexico State University, University of New Mexico, and New Mexico Institute of Mining and Technology; a large number of private energy exploration and production firms; and a rapidly expanding energy research, development, and demonstration industry are all deeply involved in private, State, and Federal funded energy-oriented endeavors.

The State has long recognized how fortunate it is to have two of the country's top scientific resources located in New Mexico. Both Sandia National Laboratories in Albuquerque and Los Alamos National Scientific Laboratory in Los Alamos are now deeply committed to energy initiatives, a non-weapons role that neither had thoroughly considered or actively encouraged prior to 1975. These entities are becoming aware that they have perhaps the country's greatest natural outdoor energy laboratory just outside their gates. New Mexico ranks third in the nation in annual production of Quads of energy, behind Texas and Louisiana. Unlike these two states whose energy-oriented economy is dominated by oil and gas, New Mexico produces its energy from more diverse sources than any other state, and with the single exception of extensive oil shale deposits, has more of a variety of conventional, alternate, and "exotic" fuels than can be found anywhere in the U.S. Because of this access and diversity, more and more of the nation's energy independence efforts will be focused on joint initiatives between the Federal scientific community and New Mexico's entrepreneurs.

Finances

A significant aspect of energy development and exploitation that traditionalists in New Mexico have avoided or not fully comprehended is money. The State is so used to being at the bottom of the economic heap that it either can't believe in new-found prosperity or just doesn't feel comfortable with it.

A major State problem in the foreseeable future is too much revenue, most of which is a result of vastly expanded energy initiatives. From a have-not state ranking 49th in per capita income as late as 1975, New Mexico has suddenly found itself with more money resources than it can comfortably handle. Already the legislature has reduced personal income tax rates some 50 percent from what they were 5 years ago. As 1980 draws to a close the Governor is proposing additional permanent tax reduction measures to eliminate an estimated surplus of $205 million from a 1981 State general fund budget of $860 million.

The 1,830 wells drilled by the New Mexico petroleum industry in 1979 was the highest number since 1961 and is rapidly approaching the record of 2,205 wells drilled in 1957. A slow down in uranium activities in 1979 is expected to be short-lived. Industry will probably have to spend an average of $1 billion a year on uranium exploration and development in New Mexico through 1990 in order to meet existing commitments. The New Mexico Bureau of Geology projects a threefold increase in coal production between 1979 and 1984, when the demand for New Mexico's coal is expected to be 48 million short tons (4.4×10^7 metric tons) a year. New Mexico's per capita income is expected to increase dramatically during the decade of the 1980's.

IMPLICATIONS AND IMPACTS

An article in *Atlantic Monthly* for April, 1978, titled "Rocky Mountain Country," said, "It's as if the mountains had awakened to find themselves named in Howard Hughes' will. Opportunity not only knocks, it thunders, and people answer the door in different moods. Some with go-getter cupidity; some with apprehension; and many with the wistful hope that jobs and better opportunities for their children can somehow be gained without consequences too disastrous to their towns, countryside, air, water, and wildlife—without total destruction of either public morals or the trout fishing."

Somehow, it seems as if we've been there before. During New Mexico's energy boom of a quarter century ago, for instance, Farmington's population increased dramatically. Housing became so short in Grants that the uranium industry was forced to construct over 1,200 units for their employees. Though hard-pressed and with financial resources stretched to the limit, most of the impacted communities managed to cope with the demands for services. Their citizens generally welcomed the influx of people and capital and reacted as if the expansion and prosperity would last forever.

It didn't. By the early 1960's most of the miners had left Grants and the petroleum industry was well into its own depression. As quickly as the economies of the impacted communities had expanded, they collapsed. Through the early 1970's housing was virtually impossible to sell and businesses floundered. Nobody except those who lived in these areas and were immediately affected really cared. Government—State or Federal—had not developed a social conscience.

The communities survived, turned to other pursuits, and eventually thrived. Now, many of the same communities are being asked to do it again. Understandably, they may be somewhat reluctant to pledge their credit and commit resources for improvements and services that past experience indicates may be needed for only a short time.

Incredibly and in spite of massive energy-related impacts being primarily the result of short-sighted Federal policies over the past 25 years, the Federal Government still takes the position that it has little or no responsibility for the problems it has caused. The official position of the U.S. Department of Interior relative to energy impacts was expressed in a letter from the Assistant Secretary for Administration and Management to the Director of the Energy and Minerals Division of the General Accounting Office in 1977 as, "State and local governments have the prime responsibility for providing the necessary facilities and services . . . since these governmental units receive net economic benefits over time from energy development activities."

It is clear that government policies at the Federal level are responsible for most of the variables and provide the majority of the uncertainties that make long-term, energy-demand determinations difficult and commitments by small impacted communities very reluctant. A slight shift of policy gears in Washington, D.C., makes a small-town mayor who makes a living doing something else aware that his community is to be "blessed" with a brand new mine, mill, generating plant or something else that requires community improvements and services that his community simply isn't ready to provide. Those so-called "economic benefits" cited by the Department of Interior usually become higher property taxes, higher crime rates, local small businesses becoming noncompetitive with the new supermarket, higher prices for labor and material, nonexistent or substandard housing, traffic problems, school problems, water and sanitation problems, and a dramatic change in life style. About the time the community begins to cope, another Washington, D.C., shift occurs and whatever was providing the "benefits" becomes obsolete, noncompetitive, not in compliance, or environmentally unacceptable, and the community is left holding a bankrupt bag.

Nevertheless, because the impacts are going to occur, it is interesting to speculate on New Mexico's energy future and controllable options within it. Whether such speculation is useful or even desirable in helping the State perceive or direct events—with or without the Federal Government—depends on one's viewpoint. In the past, the State's primary reaction to economic opportunity has been one of passive indifference, an attitude its citizens probably won't tolerate in energy development. The magnitude of major decisions, impacts, and changes originated and influenced by external-energy economics and the rapidity of their occurrences requires constant monitoring, response, and participation by the State and its local government subdivisions.

Controllable options include extraordinary expansion of economic opportunities beyond furnishing raw material. They also include attempts to influence Federal decision-makers to take some responsibility for making certain energy development is not mismanaged. This does not imply Federal management with "Catch-22" categorical grants, loans, and controls and the "strings attached" that delight the Federal paper-shufflers and leave the frustrated local official wondering why he even bothered to apply.

Changes are taking place with a speed that several years ago would have seemed impossible, suggesting that the time has come for decisions at the Federal level to mitigate energy-related impacts instead of continuing to study them. We know, for example, that large numbers of expensive, extensive, and sometimes duplicative reports commissioned by State and Federal entities demonstrate socioeconomic energy-oriented impacts on existing communities. Few had to be told that Farmington, Grants, and Gallup are being substantially affected by new activities and expansion of existing ones. However, many of the new energy actions in the San Juan Basin will occur in areas that have little or no community service base to begin with. It is unfortunate for the planners that industry provides its impacts where the need exists, not where government suggests they ought to be. This is a major cause of "after the fact" reaction to boom-town symptoms that, if unpleasant, could have been avoided if government and industry were not in perceived or actual adversary positions, permitting reasonable interchange of information and joint venturing.

Besides communities like Crownpoint and Cuba, names like Bisti, Burnham, Thoreau, Prewitt, Hospah, Star Lake, and Torreon will become familiar to New Mexicans as new and expanded uranium and coal activities develop. According to one State study (Governor's Energy Impact Task Force, 1977, p. IV-38) over 72,000 new persons must be housed and provided with urban services in McKinley, San Juan, and western Valencia counties during the 1980's if just the announced developments take place. This represents a 46 percent increase in the 1976 population of the region and will require an estimated $224 million in new or improved community services, highways, and education facilities. What is not indicated is that about half of this massive impact will be felt in areas where no community presently exists. If these impacts become the type of development representing the undesirable elements of rapid and mismanaged growth, who should be blamed and whose responsibility is it to resolve the problems?

The State has little control over the cause of the problems, that of furnishing fuel to a demanding nation. The State does have the right and obligation to insist that those who create the demands and truly reap the benefits from energy production—industry, consumers, and the Federal Government—share the service, social, and financial burdens.

In this respect, it is worth considering that New Mexico use a significant portion of its new-found, energy-related wealth to mitigate these impacts, instead of insisting that the Federal Government do so. So long as the Congress imposes no unreasonable restraints on the State's ability to levy fair taxes on energy activities which can be passed through to the industry's customers, the State could and should bear the responsibility for assisting its citizens through its normal appropriation procedures.

PROJECTIONS

It doesn't take a great deal of crystal ball gazing, opaque as it may be, to make a few predictions based on known resources and geologic evidence.

OIL

The potential for encountering large new oil deposits in stratigraphic traps in mature provinces and relatively unexplored regions is very large. For example, more than 14,000 wells have been drilled in a 10,000 mi^2 (2.6 × 10^4 km^2) area of the San Juan Basin. However, if every well that did not penetrate sedimentary units below the Jurassic strata were removed from the map, the region would appear to be untested by the drill. Only 16 wells have penetrated to test oil and gas possibilities in the deeper Pennsylvanian rocks. Yet, less than 50 mi (80 km) away, in the southeastern corner of Utah, is the largest stratigraphic accumulation of oil in the entire Rocky Mountains— the 400 million barrel Aneth Field, producing from Pennsylvanian rocks. It is not unreasonable to assume that oil accumulations which could add significantly to our State's current 450 million barrel oil reserves will be discovered in the San Juan Basin's deeper sedimentary units in this decade.

Gas

Higher prices have stimulated a great deal of new exploration for gas and the successful development of this resource in less permeable sandstones that were recently considered noneconomic in the southeastern part of New Mexico. In-fill drilling on 160 acre (65 ha) spacing in the San Juan Basin has halted the decline in that area's production. The relatively untested Albuquerque Basin from about Socorro to Bernalillo is receiving a great deal of exploratory interest for possible new gas production, as well as the southwestern part of the State that some explorationists have suggested is a part of the western overthrust belt. It would appear likely that the 1980's will see the establishment of significant new natural gas fields.

Coal

It appears that New Mexico has sufficient strippable coal reserves to satisfy the State's long-range needs. Although opening up the Star Lake-Bisti area to additional coal mining by construction of a railroad will accelerate production, there is some doubt that our coal reserves can be competitive for export with those in Wyoming and Montana. New Mexico's coal occurs in relatively thin seams that may average about 6 ft (1.8 m) in thickness while coal in the northern Rockies is encountered in 90 to 100 ft (27 to 31 m) beds. Decisions to encourage production of synthetic fuels and electricity for export from mine-mouth plants might create additional demands for New Mexico coal, but present projections would indicate that the next ten years will see coal production in the range of 30-35 million short tons (2.7×10^7–3.2×10^7 metric tons) a year, approximately double current levels.

Uranium

The market for yellowcake is presently soft, but this is only a temporary situation. It is inescapable that nuclear fuels offer the single best option available to the United States to carry us through the crucial period during the next 20 to 30 years while transition to renewable fuels occurs. Even if nothing dramatic takes place to change the energy picture, such as the blackouts predicted by some utilities and potential for suspension of crude oil shipments from the Persian Gulf region, uranium production must increase two to three times over the next decade to fuel reactors currently under construction. Substantial deterioration of the nation's energy position would escalate these projections upward.

Geothermal

Perhaps the most intriguing and practical new energy application affecting New Mexico's population is one that receives little attention. The Union Oil Company/Public Service Company of New Mexico joint venture to develop a hot-water regime in the Valles Caldera of the Jemez Mountains will furnish new electricity generating capacity of between 400 and 1,200 MWe over the decade of the 1980's. Approximately 1,200 MWe represents about one-third of the combined capacity of the Four Corners and San Juan power plants when fully developed, and would supply enough electricity to support a population of over one million people. In addition, Los Alamos' experimental Hot Dry Rock geothermal project at the Fenton Hill site is moving into a commercial phase with the development of a 30 MWe installation, joint-ventured with Plains Electric.

But that isn't all. As a direct result of the State's Energy Research and Development program, a warm-water geothermal regime has been established at Las Cruces. Present plans call for new construction at the New Mexico State University campus to be heated by geothermal waters, together with retrofit of existing buildings. Recent drilling operations indicate a potential for furnishing a substantial part of the Las Cruces area's space-heating demands from hot water. Investigations conducted over recent years indicate the entire Rio Grande Valley, where some 60 percent of New Mexico's population is located, is favorable for direct heat, nonelectric, geothermal applications. If, for instance, large volumes of water can be produced from the thick, unconfined aquifer underlying Albuquerque from depths of 10,000 to 16,000 ft (3,048 to 4,877 m), its temperature would range from 260°F (127°C) to 380°F (193°C). Since water boils at about 192°F (89°C) at Albuquerque's mile-high (1.6 km-high) altitude, the implications for space heating and generating electricity from a perpetual geothermal resource are staggering! What industrial enterprise manufacturing a product wouldn't be interested in controlling its own energy source? And what developer shouldn't be looking to independence from natural gas? What public body shouldn't be examining less expensive, uninterruptible fuel options? It is not unlikely that New Mexico will become the nation's showplace for applications of this important renewable fuel resource during the 1980's.

Solar

Development and installation of passive-solar mechanisms for space heating will continue to be an important element of planning for future construction in New Mexico. Thousands of our residents are already benefiting from New Mexico's unique solar exposure. With additional dialogue, many more thousands of New Mexicans will take advantage of these relatively simple and inexpensive techniques that result in conventional fuel savings. The State has established its own Solar Institute at New Mexico State University in Las Cruces to assist its citizens in applying solar technologies. The Federal laboratories in New Mexico are presently involved in the bulk of the nation's higher technology in solar research and development. Major breakthroughs in designing low cost, efficient photovoltaics and solar panels will likely occur through their initiatives in the 1980's.

CONCLUSIONS

Barring a major economic disaster, the growth New Mexico has experienced recently may seem small compared to observations 10 years from now. Only a few short years ago the greatest obstacle to economic development and opportunity in the State were distance and remoteness. Now, these factors together with the wide open spaces, exceptional climate and, in most of New Mexico, intense blue skies, sparkling nights, and clear water are precisely what many Americans who can afford it are moving here to obtain. So far the State has been confronted with an influx of people generally on an individual and unorganized basis who have simply found a life style they liked. The long-range economic future of the State depends upon attracting industries that can make use of the resources described above together with a commitment by New Mexico's citizens and decision-policy makers to accommodate them on terms that preserve the invaluable atmosphere and attitude of being unique.

It is not unreasonable to expect that, just as a century or so ago major communities and industrial complexes developed around transportation corridors of rivers and railroads, the new and expanding businesses of the next decades will locate where assured energy supplies, natural resources, and other favorable amenities exist. It is inescapable that New Mexico's vast energy resources are the keystone to a prosperous economic perspective.

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*Statistical information in text derived from these sources unless otherwise noted in text.

Toyaland; a butte composed of the upper members of the Jura-Trias system, as seen from the housetops of Zuñi. Photographed on wood. (From U.S. Geological Survey, Sixth Annual Report, 1885.)

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G5105041 (1980-81)

Final Report

RADIONUCLIDE AND HEAVY METAL DISTRIBUTION IN RECENT SEDIMENTS OF MAJOR STREAMS IN THE GRANTS MINERAL BELT, N.M.

by

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[Note: The following has been excerpted from the above named report. The report, in its entirety, has been retained in committee files.]

March, 1983

SUMMARY

In the absence of historic geochemical baseline data for the Grants Mineral Belt, environmental changes resulting from uranium mine-mill activities can only be determined by indirect methods. A methodology for determining the age of recent sediments in streams draining the region has been established based on combined geomorphic, stratigraphic, and radiometric dating techniques. Because clay-rich sediments retain possible radionuclides and heavy metals derived from mineralization and mined sources, sample sites which contain fine-grained deposits that both predate and postdate mine-mill activity were located in abandoned-channel segments (oxbows) of major streams draining the eastern Grants Mineral Belt. Aerial photographs (and derivative maps) taken between 1935 and 1971 provided the historical and geomorphic documentation of approximate dates of oxbow formation and ages of alluvial fills in the abandoned-channel segments. Pits were dug at these oxbow sites to determine stratigraphy and composition of the deposits. Samples collected from pit walls and auger holes below the pits were subjected to radiometric analysis by gamma ray spectrometry for the artifical radionuclide Cs-137 and the natural radionuclide Pb-210 as well as other U-238 and Th-232 daughters. Because of the dynamic nature of the system, absolute dating with Cs-137 was not possible but samples could be dated as either pre- or post-1950. The 1950 date is important because it marked the beginning of the uranium activity in the region. The Pb-210 dating was not possible because background Pb-210 was very high relative to fallout Pb-210. It may be possible to separate effects of uranium mining and milling activity by comparing U-238 daughter accumulation to daughters in the Th-232 series.

Sediments dated by the correlative Cs-137, stratigraphic, and historic techniques were then analyzed for radionuclides and trace metals which would be associated with uranium ores. The U-238 daughters are generally high in the region and little difference was observed for their values between the control site and the sites in the uranium mining and milling region except for the Paguate Reservoir site. Recent sediments at Paguate clearly show elevated levels of U-238 daughters in sediments unambiguously dated after the mid 1950's. Sediments from the Jackpile uranium mine have been trapped in the reservoir fill.

Trace metals were also analyzed in old and more recent sediments and As, Se, Cd, Hg, and U show elevated values on a regional basis but no correlation with age (i.e. pre- or post-1950). These elevated trace metal values may simply be due to their association with the regionally mineralized material.

IV.. SUMMARY, CONCLUSIONS, AND SUGGESTIONS FOR FURTHER WORK

A methodology for establishing the age of recent sediments in streams draining a major uranium mining and milling region has been established based on combined geomorphic, stratigraphic, and radiometric dating techniques. In the absence of historic geochemical baseline data for the region, environmental changes resulting from uranium mine-mill activities can only be determined by indirect methods.

The primary goal of geological studies was to determine the age of recent sediments in order to evaluate possible contributions of radionuclides and heavy metals to alluvial deposits of the lower Rio Puerco-San Jose drainage system. These studies focused on (1) processes of sediment transport and deposition along the Rio Puerco and Rio San Jose downstream from the lower Arroyo Chico and Rio Paguate areas, and (2) identification of stream deposits that immediately predate and postdate the onset of uranium mine-mill activity in the early 1950's. Because clay-sized sediment is primarily responsible for sorption of radionuclides and heavy metals, datable sites of clay-rich sediments were sought along the drainage system downstream from the major mine-mill areas of the eastern Grants Uranium Belt. Abandoned channel loops (oxbows) were chosen for study because they are easy to locate on aerial photographs taken since 1935, can be assigned an age for development, and commonly have thick clay-rich fill. Adjacent reaches of the present stream channel were studied for comparison.

Pits were dug at oxbow sites to determine stratigraphy and composition of deposits. Samples collected from pit walls and auger holes below the pits were subjected to radiometric analysis by gamma ray spectrometry for the artificial radionuclide Cs-137 and the natural radionuclide Pb-210 as well as other U-238 and Th-232 daughters. Because of the dynamic nature of the system, absolute dating with Cs-137 was not possible but samples could be dated as either pre- or post-early 1950's. The Pb-210 dating was not possible because background Pb-210 was very high relative to fallout Pb-210.

Sediments dated by the correlative Cs-137, stratigraphic, and historic techniques were then analyzed for radionuclides and trace metals which would be associated with uranium ores. The U-238 daughters are generally high in the region and little difference was observed for their values between the control site and the sites in the uranium mining and milling region except for the Paguate Reservoir site. Recent sediments at Paguate clearly show elevated levels of U-238 daughters in sediments unambiguously dated after the mid 1950's. Sediments from the Jackpile uranium mine have been trapped in the reservoir fill.

Trace metals were also analyzed in old and more recent sediments and As, Se, Cd, Hg, and U show elevated values on a regional basis but no correlation with age (i.e. pre- or post-1950). These elevated trace metal values may simply be due to their association with the regionally mineralized material.

From study of aerial photographs, there appears to be much larger changes in configuration of the inner channel and inner floodplain between 1954 and the present (29 years) than between 1935 and 1954 (19 years). These changes may be related to hydrologic changes in the drainage basin and to changes in vegetation on the inner floodplain. Many oxbows, particularly those abandoned prior to 1954, have not developed extensive clay-rich deposits. Instead, the fill is predominantly sand along with poorly-sorted sediments from small tributaries eroding adjacent valley fill. Along the Rio San Jose and the lower Rio Puerco, sediments from different source areas may be distinguished in a general way by color.

Although deposits have been placed in a general time framework, correlations between individual fining-upward deposits and individual recorded floods remain to be completed. Changes in the geometry of the inner channel and complexities in the records for gaging stations along the Rio Puerco make it difficult to determine the number of floods which inundate each sample area. By tracing floods downstream from distinctive headwater areas, it may yet be possible to correlate some sand-plug or inner-floodplain deposits based on further work with tamarisk germination ages and depth of burial of former surfaces.

The following recommendations are made:

1) The approach developed in this study can be used to evaluate mine-mill effects in fluvial environments downstream from the activity. The procedures should be generally applicable to western mining regions.
2) Sediments deposited in environments closer to mine-mill operations should be studied, especially in areas which appear to be 'sinks' such as Paguate Reservoir and the McCarty's marshes along the Rio San Jose.
3) A study of this nature in the Rio Puerco of the West near Gallup may help answer questions regarding the effects from the United Nuclear tailings pond spill in 1979.
4) It may be possible to separate effects of uranium mining and milling activity from natural background by comparing U-238 daughter accumulation to daughters in the Th-232 series.

PROPOSAL FOR A HAZARDOUS WASTE TASK FORCE

Executive Summary

A licensed hazardous waste treatment, storage and disposal facility in New Mexico is urgently needed. A facility strategically located near waste generators, without threat to health or environment, would provide an incentive for industries to locate in New Mexico. High costs for out-of-state waste transportation have led to illegal dumping of hazardous wastes, a practice which would be curtailed by an in-state facility.

At the present time the applicant for a State-issued permit to operate a hazardous waste treatment and disposal facility selects a site and describes the design and operation of the proposed facility. The Hazardous Waste Bureau of the Environmental Improvement Division (EID) then reviews the proposal, based mostly on studies and information provided by the applicant.

New Mexico and industry would be well served if, 1) suitable siting regions were already identified when an application is first filed, and 2) critical evaluations of state-of-the-art technologies in hazardous waste management were available to aid permit reviewers and the public. There is a potential conflict of interest in performing this work by the regulatory agencies themselves.

Interdisciplinary task groups from the State's major research institutions are proposed to address the two deficiences outlined above; however, subcontracting to reputable consulting and drilling firms is both desirable and anticipated. The scope of work is very broad, including, among other areas, field and laboratory studies, computer analyses, economic analyses, thorough literature surveys and inspections of existing sites. The duration of the project is about three years and requested funding level is $605,000 for the first year and about $1,775,000 total project cost.

I. INTRODUCTION

Severe ground water contamination has occurred recently in Albuquerque's South Valley, resulting in closure of a high capacity municipal water supply well. Industrial organic chemicals appear to be the source of contamination. Fortunately, Federal and State regulations stemming from the Resource Conservation and Recovery Act of 1976 should go far in preventing similar occurrences of ground water contamination in the future.

One result of these hazardous waste regulations is that wastes are transported to a treatment or disposal facility outside of New Mexico. Companies which comply with existing regulations may find that out-of-state transportation of hazardous waste comprises a significant financial burden. To avoid this expense, some trucks carrying hazardous wastes illegally empty their contents in remote areas, a practice called "midnight dumping". Without an in-state waste treatment and disposal facility, new high technology industries (most of which are generators of hazardous wastes) may choose to locate in other states which do have facilities.

In the past there have been only a few inquiries by commercial waste treatment and disposal facility operators to locate in New Mexico. Their reluctance may have been partly attributed to New Mexico's lack of regulations on hazardous waste operators' however, these state regulations should go into effect in 1983. Furthermore, in-state facilities are likely to become more attractive now that some nearby facilities in Colorado and California are closed.

A company that wants to construct and operate a hazardous waste disposal facility in New Mexico must apply for a permit to the New Mexico Department of Health and Environment. One of the most important parts of the permit application is the site selection. Site selection must consider a large number of factors such as geology, hydrology, air quality, and other health and environmental issues, as well as economic issues which center on transportation costs. At present the Department of Health and Environment must rely on the applicant to select and evaluate a site, because no rigorous state-wide investigation has been conducted to locate a hazardous waste treatment or disposal facility. Costs to private industry of an extensive State-wide or regional survey to locate a site may be a deterrent to locating in New Mexico, especially in light of the uncertainty that the State will permit their designated site. In some instances, commercial operators seeking to locate a hazardous waste management facility in our State may be faced with an even larger problem, namely: overcoming public opposition. Such was the case a few years ago for the Malone Company who wanted to apply for a hazardous waste disposal permit west of Hatch, in southern New Mexico.

Another important aspect of the facility permit review process is evaluating the technical feasibility of the proposed method of treatment or disposal, particularly with respect to health and environmental standards. A great deal of research has already been done and continues; however, State regulatory agencies may be faced with conflict of interest in conducting their own research on technology or siting. Integrated waste treatment facilities are being designed in the U.S. and many have been operating for years in Europe. An evaluation of state-of-the-art technologies, with an emphasis on conditions in the Southwest, would provide our Health and Environment Department staff with necessary technical performance data to evaluate all aspects of hazardous waste treatment and disposal facility applications. Such technical and economic data could also provide a basis for a decision on whether a State-owned and operated facility is preferred to a commercial operation by private industry.

II. OBJECTIVE

1. Designate regions within New Mexico which may be acceptable to public and industry for locating hazardous waste treatment, storage, and disposal facilities.

2. Inventory the existing hazardous waste quantities, compositions, locations, generation process and handling.

3. Compile and evaluate the state-of-the-art for technologies in hazardous waste treatment, storage, and disposal, including economic considerations, potential environment impacts, and public relations, as they may pertain to conditions in New Mexico.

III. OVERVIEW OF APPROACH

A. Organization

The Hazardous Waste Task Force, administered by the Director of the New Mexico Engineering Research Institute of the University of New Mexico in Albuquerque, will be comprised of interdisciplinary team of scientists and engineers from the State's major research institutions. The Governor will appoint an Advisory Committee representing interested citizens, legislators, industry representative, State agencies and national laboratories. The Director will also coordinate information dissemination to the public. Major task groups to be designated include, 1) Site Evaluation, 2) Waste Inventory and 3) Technology Assessment. Each task group will be headed by a Task Group Leader appointed by the Director. The Task Group Leaders, along with the Director of Administration, will select the best available task group members, coordinate activities, promote information exchange within the group, compile a final report, and report to the legislature. Figure 1 illustrates the project organization.

B. Task Group Activities

1. Evaluation of Criteria and Strategies for Site Selection

The first step in evaluating a site will be to determine criteria for selection of an acceptable site and develop a means to account for diverse geographical areas, earth materials, geologic stability, hydrologic environments, economic constraints and social concerns in a quantifiable fashion. Inasmuch as a number of methodologies already exist, the proposed work will focus primarily on assessing their suitability to New Mexico's environment through the use of numerical simulations of contaminant transport, optimization techniques, and statistical analyses. New screening methods will be developed only if necessary. Base maps will be prepared and public input solicited from the

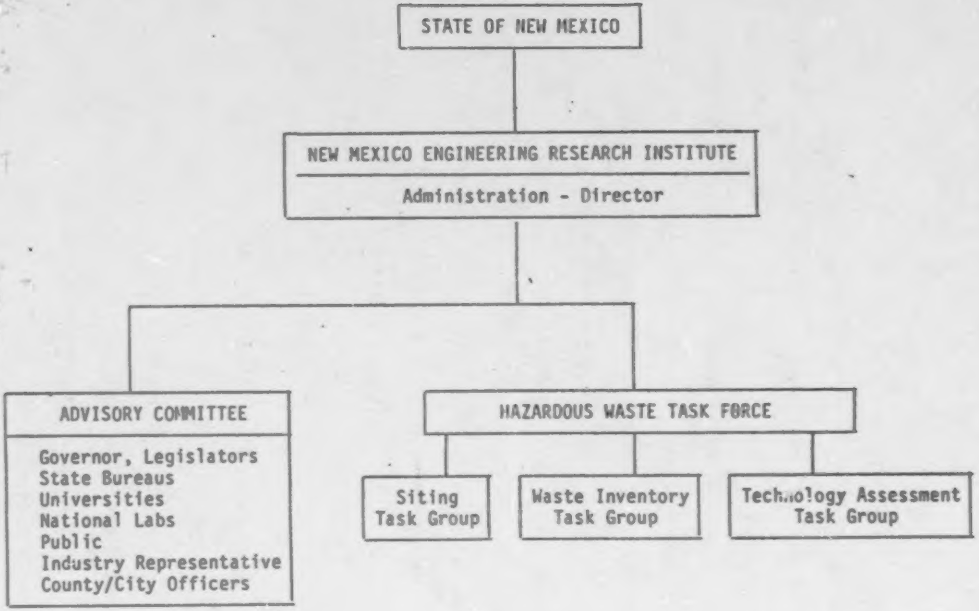
STATE OF NEW MEXICO
NEW MEXICO ENGINEERING RESEARCH INSTITUTE
Administration - Director
ADVISORY COMMITTEE
Governor, Legislators
State Bureaus
Universities
National Labs
Public
Industry Representative
County/City Officers
HAZARDOUS WASTE TASK FORCE
Siting Task Group
Waste Inventory Task Group
Technology Assessment Task Group

FIGURE 1. Organization of Hazardous Waste Task Force

Advisory Committee to designate the least desirable or most attractive regions for site locations. This phase will lead to selection of several potentially acceptable siting regions and the designation of drilling sites within these regions.

Site soils, geology and hydrology will be substantiated by a modest drilling and sampling program. Various tests will be run in the field as well as in the laboratory to determine the parameters which control the direction and rate of contaminant movement.

Based on field and laboratory results, the long-range impacts due to accidental releases of hazardous wastes will be predicted from mathematical models. the degree of confidence in the model prediction will have been established by using the model to predict the infiltration of fluid during a controlled field experiment.

2. Waste Inventory

This task group will first inventory existing hazardous waste generators, waste quantities, and compositions. Available records in the State Environmental Improvement Division's Hazardous Waste Bureau and U.S.E.P.A. will be reviewed first. These groups have already compiled a significant inventory on waste transportation, storage, and treatment through RCRA regulations. Where necessary, additional information will be obtained by personal interviews, mail questionaire, phone contacts, field inspections, and laboratory analyses. The hazardous waste inventory will be used to identify the waste treatment and disposal technologies most compatible with waste streams generated in New Mexico. Furthermore, the inventory will be used by the Site Evaluation Task Group to locate the geographic distribution of waste generators and to identify the chemical composition of wastes for use in laboratory soil column leaching tests and contaminant transport analyses.

3. Technology Assessment

The principal activity of the Task Group is to survey the state-of-the-art in hazardous waste treatment, storage and disposal. Methods surveyed may include landfill disposal, subsurface injection, incineration, solar evaporation, chemical and biological neutralization, containerization, and recycling. Concepts studies may include mobile facilities, fixed location facilities comprised of more than one type of treatment or disposal unit, and facilities which recover heat or generate electricity as a by-product of the incineration of hazardous waste, as well as municipal waste. Many of these concepts are currently in use throughout Europe. A number of hazardous waste management firms in the U.S. have developed expertise in a variety of techniques.

The objectives will be achieved by a thorough review of existing literature in technical journals, contact with hazardous waste management industry representatives, attending professional symposia, a survey of other countries and state's public relations and technology management experience through mail and phone communication, visits to existing facilities, and contact with ongoing research in the U.S. government and other laboratories. Cost analyses, performance statistics, actual versus predicted environmental impacts and public perceptions of various alternatives will also be inventoried. Alternatives of technologies for New Mexico which require additional research will be identified.

Based partly upon the inventory of prior experiences, public relations and media experts will develop procedures for effectively transferring information between the public, private industry and the regulatory agencies in order to prevent unnecessary adverse public reaction to construction and operation of a facility.

Results of this investigation will be compiled and summarized in the form of tables or illustrations wherever possible, as part of a report of findings and recommendations. The recommendations will include an assessment of the feasibility of a State-owned and State-operated facility, joint ownership and operation by the State and public utilities, and cooperative efforts with neighboring states.

C. Advisory Committee

The Advisory Committee on Hazardous Waste Treatment, Storage and Disposal provides an important vehicle to serve the public, industry and the task groups. The advisory committee will be informed of all task group activities, progress, and expenditures. The siting task group will request input from the Committee regarding site selection criteria. The Advisory Committee will review and comment on recommendations included in the completed reports from the task groups before final publication by the Hazardous Waste Task Force Director.

IV. BUDGET

The proposed program is intended to be complete after three years, as shown in Figure 2. The start and completion of tasks shown are approximate; some projects may overlap. Appropriations will be requested annually, as more accurate funding forecast will be available when the specific projects are detailed. An initial expenditure of $605,000 is requested for the first year as outlined in Figure 3. Second year costs are anticipated to be approximately $740,000, and final year cost estimate is $430,000.

Appropriations from the legislature will be to the New Mexico Engineering Research Institute. The Director will be responsible for distributing funds to the task group members through their respective universities. The task group leaders will write detailed proposals and budgets with task group members which are consistent with the work and funding level in this general proposal.

A. STATEMENT OF WORK FOR SITING TASK GROUP

1. Site criteria evaluation

The Siting Task Group will compile various site ranking methodologies which have been proposed or have been used by others. The Task Group will focus on the State-funded low-level radioactive waste disposal site investigation by Dr. John Hawley of the New Mexico Bureau of Mines. Dr. Hawley's findings designate several areas of the State ranging in size from a few to more than one hundred square miles. His study is based on existing hydrogeologic information applied to an untested set of criteria which do not take into account public opinion or economic constraints imposed by transportation costs. Moreover his siting study and the Hazardous Waste Siting Act proposed by Reps. Thompson and Silve in 1983 assume that land filling is the only disposal option and do not consider treatment methodologies. Different siting criteria may be more appropriate for other types of disposal and treatment systems.

A principal problem to be addressed by the Siting Task Group will be selecting criteria that are practical, meaningful, and acceptable for the public.

Figure 2. Project Activities Time Line

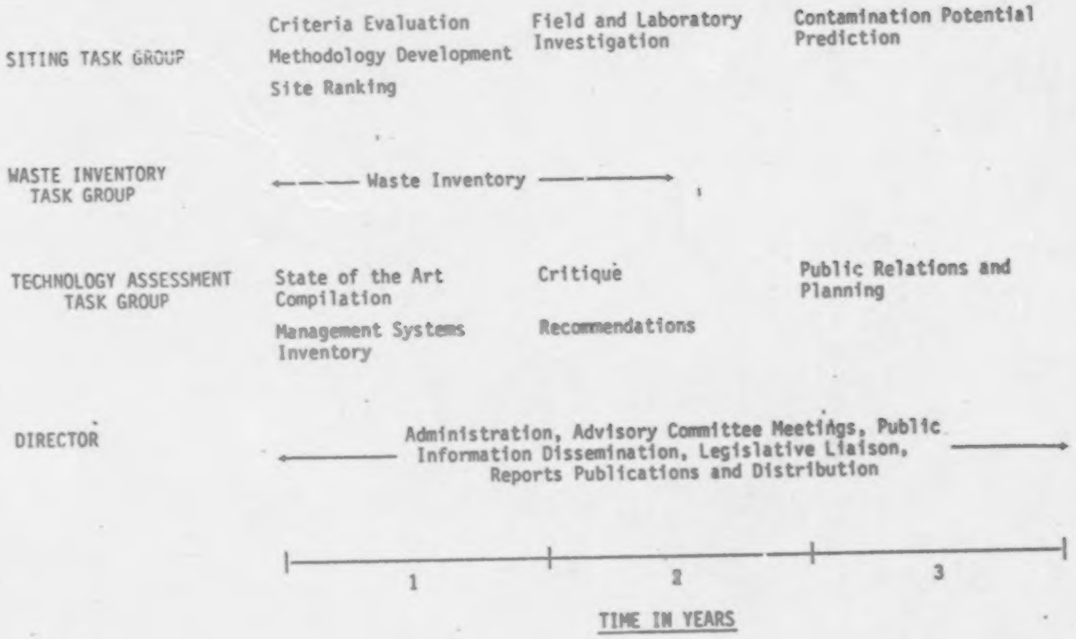
SITING TASK GROUP
Criteria Evaluation
Methodology Development
Site Ranking
Field and Laboratory Investigation
Contamination Potential Prediction
WASTE INVENTORY TASK GROUP
Waste Inventory
TECHNOLOGY ASSESSMENT TASK GROUP
State of the Art Compilation
Management Systems Inventory
Critique
Recommendations
Public Relations and Planning
DIRECTOR
Administration, Advisory Committee Meetings, Public Information Dissemination, Legislative Liaison, Reports Publications and Distribution
1
2
3
TIME IN YEARS

Figure 3. Proposed Budget of TASK GROUPS and ADMINISTRATION in Thousands of Dollars

	YEAR		
ACTIVITY	1	2	3
Siting	175	350	170
Waste Inventory	160	90	
Technology Assessment	220	250	210
Program Management Publication, etc.	50	50	50
Total	605	740	430

Questions to be considered may include, for example: should the site be one mile or five miles from the nearest source of surface water; should the depth to the water table exceed 100 feet or 1000 feet; can a shallow water table condition be tolerated if the subsoil composition is mostly a highly sorptive, low-permeable clay?

General criteria such as these may be evaluated for hypothetical cases by using numerical models of solute transport in saturated or unsaturated media, analytical solutions, or recently developed stochastic approaches. All these methods can be used to estimate the concentration and time of contaminant breakthrough at arbitrary points in time or space for the purpose of evaluating site selection criteria from an aquifer contaminant standpoint. Discussions with the Advisory Committee will be particularly useful in the selection of criteria pertaining to transportation routes, economic factors and other public concerns about the environment.

2. Siting methodology

The availability site ranking methodologies which best accommodate the selected criteria will then be tested for their ability to predict contamination at existing waste sites in New Mexico. The method which most accurately predicts the known occurrence of contamination may be designated for use in ranking aquifer contamination potential.

In order to include all siting criteria developed earlier, a systems engineering approach using operations research techniques may be employed to locate the optimal sites. These methods are routinely used in engineering decision-making processes when there are a number of criteria which must be considered.

3. Site Ranking

After appropriate criteria and site-ranking methodology are selected, the State will be surveyed to designate approximately six regions having acceptable siting characteristics. To facilitate analysis and public review, State base-map overlays will be prepared to show acceptable and unacceptable siting regions, land ownership and mineral rights status, land-use patterns, locations of hazardous waste generators and transportation routes.

4. Field and Laboratory Investigations

Because the site ranking process is only intended as a rough approximation of the contamination potential and overall suitability for a hazardous waste facility, only existing data reported in the literature or estimates of actual hydrological conditions are used in the site ranking analyses. To make a forecast of the actual time it might take for contaminants accidently released from a site to move through the subsurface to points of water use or to predict whether these concentrations are likely to exceed health standards, field and laboratory analysis of actual soil and aquifer properties are necessary.

The scope of the proposed field and laboratory program is limited to the minimum necessary to confirm the preliminary results of the site ranking analysis. A hazardous waste facility operator applicant would perform more detailed testing. In one or two areas within the top few of the most suitable sites, detailed field maps of site geology will be prepared with an emphasis on fracturing and faulting. Several deep boreholes will be drilled and analyzed along with seismic geophysical surveys as a preliminary assessment of subsurface conditions. Drill cuttings and core samples will be collected for visual, mechanical, and hydrologic analyses; geophysical logs of boreholes will be run for stratigraphic correlation to detect faulting and facies changes. Baseline data will be collected on natural fluid movement, water quality and other hydrologic conditions. This will require field instrumentation to measure precipitation, wind velocity, evapo-transpiration and soil moisture conditions during the year, as well as analyses of soil moisture and ground water for chemical constituents and isotopes such as tritium and chloride 36. A field infiltration experiment will be performed to evaluate monitoring instrumentation which may be used during operations and study processes controlling the movement of fluid and tracers through soil and rock under a worst case or accident condition. Column leaching studies of contaminant and rock interaction will be conducted to determine sorptive and dispersive properties of soil and rock using expected waste types identified in the waste inventory. Both the field infiltration and column leaching studies will include determinations of the soil permeability and water storage characteristics under saturated and unsaturated conditions. Undisturbed core samples may also be collected to determine these vital soil characteristics. The deep boreholes into the underlying aquifer will be completed in a manner which will permit preliminary tests to determine aquifer hydraulic properties, to monitor seasonal water table fluctuations, and to collect water quality samples from the aquifer.

5. Contamination Potential Predictions

Data collected during the field and laboratory program will be tabulated for interpretating hydrogeologic conditions. Hydraulic properties determined from representative earth materials will be input to mathematical models for predicting the rate of contaminant movement and concentration of contaminents at points of present or foreseeable future use. Model predictions will be checked against the shallow-depth, short-term field infiltration experiment observations in order to select the most reliable model for making long-range forecasts of the threat to ground water or surface water. This model will then be run using field and/or laboratory data to predict impacts due to various accident scenarios. The acceptability of the potential impacts will be determined in collaboration with the Advisory Committee. Advantages and disadvantages of the various sites will be discussed in the final report.

Results of the field and laboratory studies and the model selection process will be presented in the form of a manual on recommended site investigation techniques to be used by State agencies or private industry during the hazardous waste permitting process. Monitoring procedures will be described which should ensure early detection of any contaminant releases. Estimates will be made of the scope of work required and costs for a detailed site investigation within potentially acceptable siting regions identified in the study.

B. Statement of Work for Waste Inventory Task Group

The Waste Inventory Task Group will answer the questions concerning hazardous waste in New Mexico of how much is there, what it is, where it is, how it is generated and how it is handled.

1. How Much Hazardous Waste Is There In New Mexico?

There are several approaches for obtaining the quantities of hazardous waste generated throughout the State. The 1976 RCRA states that the persons generating hazardous wastes are responsible for reporting their activities. Therefore, records are available in the State and at the U.S.E.P.A. and will provide a starting point for information gathering. Generally, reporting is required by generators of more than 1000kg of hazardous waste per month, and, generally, operators are excluded from most all requirements if they produce less than 1000kg/mo., they never have more than 1000kg on site and they dispose of the waste in a specified manner. However, the small quantity generator exclusion is rather extensive and the 1000kg limit drops to 1kg if certain wastes are produced. Another exclusion concerning the passage of wastes through a sewer system to a public-owned treatment works and other such exclusions will be closely scrutinized for information gathering since there are partial exclusions for small generators but even this waste must be taken to an EPA or state permitted storage, treatment, or disposal facility. Additionally, the small quantity limit is being considered for reduction to 100kg and reported information is not generally available. Therefore, a significant effort may have to be expended using means other than collecting reported data to obtain the quantities of hazardous wastes. Additional information will be obtained with the help of State Bureaus by personal interviews, mail questionaire, telephone and field inspections.

2. What are the Hazardous Wastes? ..

Persons generating waste are responsible for determining if their wastes are hazardous and reporting such. Therefore, much information should already exist in State and Federal records. However, additional information may be sought using methods presented in the preceeding paragraph to complete the existing records by taking due account of small generators having multiple sources such as universities. Ill defined wastes in existing reports may require sampling and analysis. The analyses shall indentify the hazardous waste according to the regulations promulgated by the EPA. Generic characteristics such as ignitability, corrosivity, reactivity and toxicity will be determined. Specific tests have been designated to identify each of these characteristics. The toxicity characteristics of the waste will be determined by applying a standard extraction procedure (simulate environmental leaching) and determining if the extract contains any substance at a level higher than 100 times the primary drinking water standards. Additionally, wastes would be classified as hazardous by listing. At this time, the listed wastes include 16 generic wastes, 69 process wastes, 222 chemical products or intermediate and 122 chemicals or intermediate designated as accute hazards. Certain wastes which have been specifically excluded from designation as hazardous at this time because they are relatively low hazard, high volume materials (e.g. coal ash and FGD sludge) will also be characterized. In general, all significant quantities of generated materials will be investigated if they have the potential to (a) pollute ground water, (b) pollute rivers, lakes, and other surface waters, (c) pollute the air, (d) burn or explode, (e) enter the food chain to endanger human health or harm wildlife, or (f) poison by direct contact.

3. Where and How is the Waste Generated and Handled?

This information will be gathered simultaneously with and using the same methods as stated above. These date will be formulated and evaluated for incorporation in recommendations concerning facility siting, transportation, process changes and appropriate technology. Consideration will be given to alternatives for waste disposal, in recognition of the fact that carefully burying waste in the ground is not always the best management option. It may, in fact, result in the loss of a resource, as well as a more significant environmental and health risk. The recommended alternative options will be presented in the following order of priority: (a) minimize the amounts generated by modifying the process involved, (b) transfer the waste to another industry that can use it (c) reprocess the waste to recover energy or materials, (d) separate hazardous from nonhazardous waste at the source and concentrate it, which reduces handling, transportation, and disposal costs, (e) incinerate the waste, or subject it to treatment that makes it nonhazardous, and (f) dispose of the waste in a secure landfill (one that is located, designed, operated, and monitored - even after it closed - in a manner that protects life and the environment).

C. State of Work for Waste Technology Assessment Task Group

The Technology Assessment Task Group will be charged with determining the state-of-the-art for all technologies that have been or could be used for the storage, treatment and disposal of hazardous waste. This complete inventory of technologies will then be reviewed for optimum applications in New Mexico. The new regulations for the disposal of hazardous wastes issued by the U.S.E.P.A. under the provisions of PCRA should ensure that health and environmental risks are minimal regardless of the treatment/disposal technology used. By forcing all companies within an industry to use acceptable disposal techniques, the regulations will tend to remove any competitive advantage associated with the use of cheaper, but environmentally unacceptable techniques. The chief problem remaining now is selection of the most advantageous disposal technique from among the many available. The costs of environmentally sound technologies available for the treatment and disposal of hazardous waste vary widely, according to the type and volume of waste handled. The costs are substantially in excess of environmentally unsound practices. Therefore, cost considerations to be reported will necessarily take into account the data provided by the Waste Inventory Task Group. Market analyses will also be performed for recoveries such as reclamation of materials and energy. The primary technologies to be investigated include incineration; waste exchanges; neutralization and chemical treatment; stabilization and solidification; lagoons, ponds and engineered storage; biological treatment (land farming); deep well injection; and secured landfill.

1. Incineration for the Disposal of Hazardous Wastes.

It is claimed that incineration may be the best disposal method for most hazardous wastes because incineration causes a tremendous volume reduction of the toxic materials and in many cases can result in a completely non-toxic final product. An added advantage is that the heat generated by the combustion of these materials may be captured and utilized to offset the costs of the waste disposal process. The products anticipated from the incineration of various toxic organic chemicals will be investigated, other methods being more cost effective for the disposal of toxic inorganic chemicals containing heavy metals. In order for an incinerator to operate without auxiliary fuel, the wastes must have a heat content of at least 5000 Btu/lb and a combustion temperature of 2200°F. Data will be acquired to determine if auxiliary fuel must be used due to low concentrations, low heat of combustion or the presence of inhibitory substances in the waste stream. Detailed evaluations will be made of the numerous variations in the basic types of incinerators, namely, rotary kiln, fluidized bed, and multiple hearth combustors. Since toxic wastes are generally in liqiud form but can be solid, liquid, sludges, or gases, the data from the Waste Inventory Task Group will be critical in the design and operation of an incinerator system and the type of pollution control system and, therefore, this interaction will be reported. The three basic resource recovery possibilties of (1) heat value, (2) chemical value, and (3) fuel value will be examined.

2. Waste Exchanges.

The ideal solution to hazardous waste problems is to change industrial processes so that hazardous by-products are not produced, or, if that is not feasible, to extract hazardous materials from the waste streams and use them as raw materials. The increased costs of disposal mandated by RCRA provide a strong incentive to reduce the waste load and recover as much of the wastes as possible. Recovery techniques to be investigated will necessarily be process- and material-specific. The wastes generated by one company might be useful to someone else, so the feasibility of a waste exchange or clearinghouse without source identity, will be examined.

3. Neutralization and Chemical Treatment.

If the wastes cannot be recycled, they can often be detoxified by relatively simple chemical treatment. The possibilities for neutralization and chemical treatment will necessarily be material-specific. Examples of general treatments to be investigated may include the following: (a) pH adjustment or neutralization, (b) oxidation and reduction reactions, (c) evaporation from a holding pond, vacuum filtration or heating, (d) adsorption on activated carbon (e) ion exchange chromotography, and (f) a very large number of processes which can be limited for investigation by using data from the Waste Inventory Task Group.

4. Stabilization and Solidification.

If a secured landfill is not available for disposal of hazardous wastes, then stabilization and solidification by encapsulation and chemical fixation may require only a well designed landfill rather than a secured landfill close to the waste source. Adequate preparation of hazardous wastes for disposal outside a secured landfill requires analytical characterization, stabilization or pretreatment and, finally, solidification. The investigations of the possible applications for this technology will also include detailed economics because of the extensive testing of the hazardous wastes required and the materials and processes involved.

5. Lagoons, Ponds, and Engineered Storage.

Lagoons or ponds are natural or man-made water bodies constructed either by digging out a depression in the earth or by erecting dikes. Lagoons are better suited for wastes with low solids content and ponds for those with high solids content. Although the basin must be isolated from both surface and groundwater, as determined by the Siting Task Group, the dry climate of New Mexico would reduce the need for flood protection. The potential for lagoon and pond treatment/disposal of hazardous waste will be investigated since this method is one of the simplest and most economical approaches and approximately 90 percent of the hazardous waste in the United States is in a liquid or sludge form. Although only a very small percentage of the total quantity of hazardous wastes generated in this State should require permanent storage, engineered storage will be investigated because it may be necessary for holding wastes until other adequate methods are developed.

6. Biological Treatment.

For many types of wastes, particularly nonchlorinated organic wastes, biological treatment is an acceptable alternative. The most commonly used type of biological treatment to be investigated is soil incorporation, also known as land farming. The wastes generated in New Mexico will be evaluated for (1) application of wastes onto or beneath soil; (2) mixing the waste with surface soil to aerate the mass and expose the waste to soil micro-organisms; (3) addition of nutrients, when necessary; and (4) remixing the soil and water mass periodically to maintain aerobic conditions. Appropriate instrumentation will be discussed to monitor the soil to a depth of 1 meter to detect any downward migration of trace metals or other contaminants. The need for large areas of land and the EPA regulations regarding land farming suggest a successful practice in the semiarid regions of New Mexico.

7. Deep Well Injection.

Deep well disposal is a system of disposing a raw or treated, filtered hazardous wastes by pumping them into deep wells where they are contained in the pores of the permeable subsurface rock, separated from other ground water supplies by impermeable layers of rock or clay. The proper geological environment will be determined for amendable waste products. The appropriate discharge depths and wellhead injection pressures will be discussed, drawing on the subsurface disposal technology used by oil and gas producers for oil field brines. Monitoring will be defined to evaluate the critical operational parameters of injection rate (pressure versus time) and to determine the extent of travel of injected waste. Critical evaluations will be made of deep well injection techniques and facilities because of operational problems that may come back to haunt; once the wastes have been injected at the depths called for in good well design, practically nothing can be done to correct a system failure, even if it is predicted in advance or detected as it happens.

8. Landfilling.

The utilization of landfill procedures for the ultimate disposal of certain hazardous waste materials will unquestionably be required in the future. The criteria for secured landfills will be elaborated. The potential for environmental damage by landfilled hazardous wastes will be defined according to the composition and quantity of waste. The environmental criteria of a suitable site will be discussed. Provisions necessary for monitoring wells and leachate control and treatment will be defined. Hazards for landfill personnel and potential air pollution problems will be identified. Investigations will be done to elaborate undesirable side effects due to chemical interactions with both the liner and other materials contained in the landfill.. Tables will be constructed to define which wastes must be segregated to prevent potentially hazardous reactions.

New Mexico Bureau of Mines & Mineral Resources
Socorro, NM 87801

A DIVISION OF
NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY

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February 18, 1983

Representative James K. Otts, Chairman
Radioactive Waste Consultation Committee
New Mexico State Legislature
State Capitol Building
Santa Fe, New Mexico 87503

Dear Representative Otts:

Inclosed is the report of the New Mexico Bureau of Mines and Mineral Resources on "Site Identification for Low-Level Radioactive Waste Disposal in New Mexico." It has been prepared by me in accordance with provisions of the "Site Identification Act," HENRCS/House Bill 397 (1981).

The report is complete except for Appendices A to C. Appendix A on Low-Level Waste Generation in New Mexico (1979-1980) needs to be updated to include statistics for 1981 and 1982.* Appendix B is a new State Geologic Map that is being published by the New Mexico Geological Society in early March.* Appendix C is the latest state map showing landownership, which I still have to obtain from the U. S. Bureau of Land Management.

As you and the rest of the committee clearly understand, this has been a very tough assignment; and at the same time it has been one of the most worthwhile service requests ever made to the New Mexico Bureau of Mines. The possible sites designated in this report are "good sites" when compared with other low-level waste facilities in the nation. However, is there really such a thing as a "good" radioactive waste disposal site? To say the least this has been a humbling experience for me. One does not lightly jump into this type of work.

Dr. Kottlowski and I feel that this effort deserves public and professional attention at the earliest possible opportunity. We would therefore like the committee's and legislature's permission to release this document in our open-file-report series. It would then be available at a nominal fee for duplication costs. The document could also serve as the basis for a somewhat more elaborate formal publication at a later date.

Sincerely yours,

John W. Hawley

John W. Hawley
Senior Environmental Geologist

JWH/dh

cc: Frank E. Kottlowski

Rep. Vernon Kerr

* Enclosed

Report to the
Radioactive Waste Consultation Committee
# of the
New Mexico State Legislature

on

SITE IDENTIFICATION FOR LOW-LEVEL RADIOACTIVE WASTE DISPOSAL IN NEW MEXICO

by

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Socorro, New Mexico

February 18, 1983

SUMMARY

In accordance with provisions of the "Site Identification Act", HENRCS/House Bill 397 (1981), five possible sites for a low-level radioactive waste disposal facility have been identified in New Mexico. National, regional and state criteria for site selection are shown in Tables 1 and 2. Site locations are shown on Figure 1. Major terrain and hydrogeologic features at each site are shown in figures 2 to 8; and site descriptions are given in tables 3 to 6. Please note that this is an identification of possible sites based on 1) review of published and unpublished information on hydrology, geology, and soils; and 2) brief visits to areas with site potential. Onsite characterization work, and evaluation of socioeconomic and legal factors have not been done. This is a state-of-the-art effort that needs input and constructive criticism from public as well as professional sectors of society.

INTRODUCTION

This is a report to the Radioactive Waste Consultation Committee of the New Mexico State Legislature relating to site identification for disposal of low-level radioactive wastes as required by the "Site Identification Act", HENRCS/House Bill 397 (1981). According to Section 3: "The purpose of the Site Identification Act is to permit New Mexico opportunity to avail itself of the lead time before 1984-1989 when the present out-of-state disposal facilities will be closed to the disposal of New Mexico's low-level waste by establishing criteria for selection of a disposal facility and by requiring the study and identification of at least three possible regional sites for disposal facilities in this state." According to Section 5 of the Act the New Mexico Bureau of Mines and Mineral Resources, in consultation with the Environmental Improvement Division and the Environmental Improvement Board, shall:

A. study low-level waste disposal requirements of this state and shall report its findings to the committee;

B. investigate all geographical areas in this state determined to be feasible sites for a disposal facility for low-level waste generated in this state, and after such investigation and analysis of the results, identify at least three possible sites for a disposal facility compatible with the criteria provided for in the Site Identification Act; and

C. report its findings and identified sites to the committee and to the first session of the thirty-sixth legislature.

Preliminary reports were made to the Radioactive Waste Consultation Committee on July 31 and December 2, 1981.

The July (1981) report contained a tabulation of low-level radioactive waste shipments by New Mexico licensees in 1978, 1979, 1980 prepared by the Radiation Protection Bureau of the Environmental Improvement Division. This tabulation (as of April 1, 1981) provided basic documentation on the waste disposal requirements of the state as requested in Section 5, Item A. Additional documentation on waste shipments in 1981 and 1982 is given in an appendix to this report.

The July (1981) report also established provisional criteria for selection of possible sites for a disposal facility in accordance with Section 3 and Section 5-Item B of the Act. General guidance for site selection at a national level is provided by U.S. Nuclear Regulatory Commission (1981) "Licensing Requirements for Land Disposal of Radioactive Waste" 10 CFR Part 61, Sections 61.40-44 and 61.50 (Federal Register 46FR38081); and basic criteria for site selection in New Mexico are in accordance with the performance objectives of 10 CFR 61:

> "Protection of the public health and safety over the long term is most important and long-term performance of the land disposal facility after [disposal] operations cease should be given greater emphasis than short-term considerations and conveniences..."
>
> "Assuring safety over the long term involves three considerations: (1) protection of individuals from inadvertent intrusion into the site and coming in contact with the waste at some point in the future; (2) protection of the general public from potential releases to the environment; and (3) stability of the disposed waste and the site to eliminate the need for ongoing maintenance of the site following closure."
>
> Disposal site "requirements are intended to eliminate, to the extent practicable, those areas with certain characteristics that are known to lead to or have high potential to lead to problems over the long term (e.g., flooding or rapid erosion of the site)".

The 10 CFR 61 site suitability criteria are listed in table 1a. Performance objectives, assumptions about waste management systems, and more specific siting criteria are outlined in table 1b. This information, which applies particularly well to arid lands of the southwest, is taken from a recent recommendation by staff members of the Idaho National Engineering Laboratory (Falconer, Hull, and Mizell, 1982).

Criteria used for site selection in New Mexico are listed in table 2. These criteria follow 10 CFR 61 guidelines (table 1a) and the recommendations of Falconer and others (table 1b). They are designed to be compatible with environmental conditions in New Mexico, particularly those relating to geology, hydrology, and geomorphic processes. With minor modification, the criteria listed in table 2 follow the guidelines proposed by Longmire, Gallaher, and Hawley (1981) for landfill disposal of (nonradioactive) hazardous wastes. While wastes such as toxic organic chemicals and metals cannot be placed at the same disposal site as low-level wastes (and pose a much more serious environmental threat), it seems reasonable to use similar criteria for site selection. The guidelines proposed by Longmire and others (1981) and the criteria listed in table 2 are relatively restrictive when compared with those developed for use in other regions of the country (Post, 1982, v. 2; and Yalcintas, 1982, v. 2). Strict adherence to these criteria should ensure that low-level waste repositories will be placed at least 5 miles from even small centers of population or farming, mining, and industrial activity.

The site selection process as applied in New Mexico attempts to locate those areas of the state where natural conditions (e.g. climate, landforms, geology, and subsurface hydrology) provide multiple barriers that assure long-term waste containment. There should be no degradation of land, water, and air quality in surrounding areas for thousands of years; and opportunities for human intrusion for resource development (e.g. soil, water, mineral, energy) should be minimal.

Shallow burial of solid waste in a secure landfill is the basic disposal strategy envisioned in this study. Such a landfill operation would be located in the upper part of a very thick zone of essentially-unsaturated earth material (vadose zone). Subsurface water-flow paths should be very long in both horizontal and vertical directions. Siting criteria require that the unsaturated zone contain a large percentage of fine-grained materials, such as clay or shale, which would physically and chemically retain waste components. Interbedded layers of clean sand or gravel, which provide effective barriers to capillary-water movement, should also be present in the unsaturated zone (Winograd, 1974, 1981).

IDENTIFICATION OF POSSIBLE DISPOSAL SITES

The December (1981) report to the Committee illustrated the results of a preliminary screening process which eliminated large areas of the state that clearly did not meet combined geologic and hydrologic siting criteria. A generalized map in the report showed remaining areas that appeared to meet general siting criteria and merited further consideration as possible disposal sites.

Final selection of possible sites was made in 1982 after study of the relatively small geographical areas that appear to meet basic siting criteria. All areas of the state were evaluated except for Indian lands, Federally protected areas (table 1b, item 12), and most lands administered by the Departments of Energy and Defense. Several areas shown in the December (1981) report were eliminated and one area was added. Location of the sites is shown on figures 1 to 6 and table 3. The sites are numbered according to their increasing distance from Albuquerque. The order does not reflect a ranking of sites. New Mexico already has a low-level waste site at Los Alamos (LASL-figure 1) where research has been done during the past 4 decades on site performance (Balo and others, 1982). A second area of interest noted on figure 1 is the Colfax locality where a large body of hydrogeologic information has been collected that is pertinent to disposal facilities in shale (Herkenhoff and Associates, Summers and Associates, 1977).

The site selection process involved 1) review of published and unpublished information on geology, hydrology, and soils and 2) brief visits to areas with site potential. It should be emphasized that no onsite characterization work has been done. Funding and time limitations precluded detailed geologic and hydrologic study of specific localities. The selection of possible sites definitely reflects the professional experience and opinion of the principal investigator, who has been making local and statewide investigations of geology-soil relationships for the U.S. Soil Conservation Service and the Bureau of Mines and Mineral Resources since 1962. Other areas that meet siting criteria probably exist in the state; but the basic geologic and hydrologic data needed for site identification are not available. The possible sites listed in this report definitely contain areas that will ultimately prove to be unsuited for any type of waste disposal. However, the sites shown on figure 1 also include many of the best locations in New Mexico for the secure-landfill type of disposal operation. These areas also deserve consideration as places for processing and temporary storage of other types of hazardous wastes. They definitely deserve immediate professional and public scrutiny (table 1b, items 8-12).

A very large amount of background information has been collected and evaluated during this study. Items pertinent to the six areas discussed are outlined in Tables 3 to 6. Detailed location data, and important institutional and cultural features of general areas that include sites are covered in Table 3. This table also lists major sources of published information on individual site areas. Table 4 deals with the physiographic setting of each possible site (e.g. climate, landforms, drainage network, and soils). Structural geologic setting, geologic hazards, and major energy and mineral resources are covered in Table 5; and Table 6 is an outline of the major hydrogeologic factors considered.

The tabular format provides a matrix for making relatively unbiased site comparisons. Type and factural quality of data in the tables 3-6 obviously varies greatly. Many items will be easily understood by nonspecialists in the earth sciences (e.g. distances to rivers, towns, irrigated farm land, and climatological data). Other items are expressed in obscure jargon that will have special significance to a very limited technical audience. The material presented in tables 3-6 (factual and speculative) clearly indicates the major areas where there will be conflicts between the public need for secure waste-disposal sites for low-level and other hazardous wastes, and other types of land use. Many of the legitimate conflicts will not be easily resolved (e.g. urban expansion or energy resource development versus siting activities), but at least these potential areas of conflict are now documented and such problem areas can be addressed in future studies.

In the following discussion of very diverse individual sites there are several common themes. No single site meets all siting criteria (Table 2). However, each area listed has certain environmental characteristics that essentially mandate its consideration as a viable site candidate. In New Mexico (as in any arid region) hydrology and geology are powerful socioeconomic, cultural, political forces. Historically there has been no intensive land use without a water-, mineral- or soil-resource base. Water availability obviously is the key factor. A valid question remains: Is the worst place for economic survival in this region the best place for low-level (or any type of toxic) waste disposal?

Area 1 -- Llano de Albuquerque (figs. 2, 8a)

Llano de Albuquerque refers to the summit plain of the extensive tableland (or mesa) located between the valleys of the Rio Grande and Rio Puerco. The tableland is bounded to the west and east by steep valley-side slopes, respectively, designated Ceja del Rio Puerco and Cejita Blanca (Lambert, 1968). Over the past half million years or so the Rio Grande-Puerco system has cut deep valleys below an early-stage alluvial plain constructed by an ancestral stream system. The early constructional phase lasted for millions of years and resulted in deposition of thousands of feet of fill in a deep structural basin of the Rio Grande rift (Hawley, 1978; Kelley, 1977). Much of this basin fill is saturated with fresh water.

The northern part of the Llano de Albuquerque and flanking river valleys are shown in figure 2; and a cross section of the area is included as figure 8a. The deeply-incised Rio Grande valley clearly has provided a base-level for the water saturated basin-fill deposits in adjacent mesa areas. The river valley has the effect of a giant drainage channel. Water table depths exceed 500 ft over most of the Llano surface (fig. 2) and probably exceed 1000 ft in a few areas (Bjorklund and Maxwell, 1961). Recent research on hydrology of desert basins (Winograd, 1974, 1981) indicates that 500 to 1,000 ft of unsaturated sand, gravel, silt and clay (vadose zone) would be an extremely effective barrier to waste migration. Furthermore, studies of soils and dated volcanic units of the Llano area indicate the summit plain has not been subject to significant erosion or deposition for the past 500,000 years (Hawley and others, 1976; Machette, 1978).

The major negative aspects of a possible disposal site on the Llano de Albuquerque include 1) proximity to the major regional urban center, 2) an extensive but deep aquifer zone to the east of the site, and 3) the clear evidence of local seismic and volcanic activity during the past 200,000 years (Bachman and Mehnert, 1978; Machette, 1978, 1982). If a disposal site could be engineered to withstand seismic shocks, then Site 1 should be considered as a viable candidate for low-level waste disposal. Note that volcanic eruptions on the Llano de Albuquerque area are a constructional process that probably will not adversely effect long-term site performance.

Site 2 - Prieta (Figs. 3, 8b)

The area of site 2 contrasts markedly with the Albuquerque intermontane basin (site 1). Sandstones and marine shales (Mancos Shale) of Cretaceous age underlie an extensive erosional valley cut by the Rio Puerco and the Rio Salado (a tributary to Jemez River). The eastern and southern part of this valley system also occupies a structurally downdropped zone adjacent to the Nacimiento Mountains and the Rio Grande rift (Baltz, 1967, 1978; Slack and Campbell, 1976; Woodward and Martinez, 1974). The area is flanked on the southwest by basalt-flow-capped Mesa Prieta; and to the northwest, there are scattered volcanic necks, such as Cabezon Peak (Ti, fig. 8b), which are erosion remnants of early eruptic centers of basaltic rocks.

Adjacent to the southwest corner of Site 2 is a plugged, 700-ft test hole (15N.2W.3) that did not yield any water for aquifer tests by the U.S. Geological Survey and Bureau of Land Management. Examination of well cuttings from this test boring (on file at the State Bureau of Mines and Mineral Resources) shows that the penetrated section is mostly clay-rich to silty shale. The area north of the well site is underlain by very thick deposits of the Mancos Shale, with very few lenticular beds of sandstone (Molenaar, 1974). The Mancos contains abundant magnesium-rich clay minerals (smectities or montmorillonites) with expansive or swelling (bentonitic) properties and high ionic adsorptive capacity. Geochemically the Mancos Shale is an ideal host media for toxic-chemical as well as low-level radioactive wastes (Longmire and others, 1981). As documented by studies of test hole 15N.2W.3, the Mancos is a very impermeable unit in the immediate site area.

The northern part of the site (dashed outline on fig. 3) is only tentatively being considered because of its proximity to the more deeply entrenched valley of the upper Rio Puerco (here an intermittent to ephemeral stream). However, it is the most stable part of the area (geomorphically) because of its position near the crest of the broad divide between the Puerco-Salado (Jemez) stream systems. Also, known faults are located only in the southern part of general area shown on fig. 2 (fig. 8b, Slack and Campbell, 1976). Soils on the Puerco-Salado divide indicate presence of a few areas where that land surface has not been subject to serious erosion for 10,000 to 100,000 years.

There are two major drawbacks to repository siting in the Mesa Prieta-Cabezon area. First, exposed shaly rocks are very susceptible to erosion (Table 4-part 2); and second, the area west of the Nacimiento structural uplift includes a general belt of relatively high seismicity (Sanford and others, 1981).

Site 3 - Huerfano (figs. 4, 8c)

The Huerfano site in the San Juan Basin south of Bloomfield (SW of Farmington) represents a combination of a number of features found at sites 1 and 2. As in the case of the Llano de Albuquerque the major landform is a tableland (mesa) summit situated hundreds of feet above adjacent valleys of the San Juan River system. Moreover, the site is underlain by thick shales of continental origin, with many similarities to the Mancos Shale. These ancient floodplain, swamp, and lake deposits of Paleocene age are designated the Nacimiento Formation. This unit locally contains lenticular sandstone beds that form discontinuous aquifer zones (Brimhall, 1972). Most water wells drilled in the Nacimiento have very low yields (Stone and others, 1983) and the unit is generally not considered to be an aquifer. Furthermore, because of the upland topographic setting of Site 3, water-saturated conditions only sporadically exist and the water table is at least 300 ft below the surface (fig. 8c).

The main aquifer in this part of the San Juan Basin is the Ojo Alamo Sandstone. This ancient river (fluvial) deposit forms a confined water-bearing unit that locally qualifies as a major aquifer (>100 gpm sustained yield of freshwater). The approximate piezomentric surface representing the artesian pressure head in the Ojo Alamo aquifer is shown in profile on figure 9c and is about 500 ft below the site surface. Flow in both the unconfined (Nacimiento) and confined aquifer systems is northward toward the San Juan River.

While the mesa summit north of Huerfano Peak is basically an erosion surface, it is capped with ancient alluvial deposits and soils, at least 100,000 years old, and a veneer of young windblown (eolian) deposits (mostly <10,000 yrs in age). The broad tableland summit has low local relief and it has not been the site of significant erosion for tens of thousands of years. No geologically-young faults (<500,000 yrs) have been noted in this local area of the Colorado Plateau province. The major problem in site selection is finding a place where a disposal facility would not conflict with development of the proven oil and gas resources of the area (Parker and others, 1977). Even considering this very important factor, the Huerfano site should be evaluated as a possible area for low-level waste disposal.

Site 4 - Jornada (figs. 5, 8d) and Site 5 - Desert (figs. 6, 8e)

The topographic setting of Sites 4 and 5 in south-central New Mexico contrasts markedly with the landscape positions of the other sites discussed. Both are located in very broad intermontane basins (bolsons) where surface drainage is not yet integrated with the adjacent Rio Grande valley system. Site 4 in the Jornada del Muerto Basin is on a broad piedmont slope constructed by coalescing alluvial fans of streams heading in the San Andres Mountains. The gravelly to sandy clay piedmont alluvium interfingers westward with gypsiferous sand and clay deposited in ancient river-channels and backswamps. These features were marginal to a broad fluvial plain constructed by the ancestral Rio Grande more than 500,000 years ago. Deposits are very similar in age and origin to upper Santa Fe Group units exposed in river-valley walls of the Albuquerque basin (fig. 8a). However, clays are common, and both sand and clay units have thick gypsum-impregnated zones (King and others, 1971; Seager and others, 1982, 1983).

Recent work by Wilson and others (1981) shows that there is an area of about 25 mi^2 extent in northeastern Doña Ana County where the water table is at least 500 ft below the surface. This area is designated as Site 4. Geomorphically it is still part of the bolson constructional topography and has yet to experience any significant erosion. Windblown sand sheets derived from the bolson-floor area to the west are also moving into the area. Sedimentation is not rapid, however; and detailed soil-geomorphic research by the Soil Conservation Service and the New Mexico Bureau of Mines and Mineral Resources shows that only about 25 ft of sediment have been added to piedmont slopes during the past several hundred thousand years (Gile and others, 1981).

Site 5 is on an ancient bolson floor surface at the southern end of the Tularosa Basin (fig. 6, fig. 8a). The surface is flanked by piedmont slopes extending from the Hueco Mountains on the east and the Organ Mountains on the west. This extensive alluvial and lacustrine plain was constructed by distributaries of the ancestral Rio Grande in Pliocene to early Pleistocene time. This river emptied into ancient lakes of the south-central New Mexico border region and constructed a huge delta in the southern Tularosa Basin and northern Hueco Bolson (Hawley, 1978; Seager, 1981). Deltaic and associated lake beds are primarily clay with some interbedded sand. At the southeast corner of Site 5, a 940-ft section penetrated by a water test well is entirely clay and shale (Knoles and Kennedy, 1958). No aquifer was encountered in this test well, which finished in limestone at 945 ft. Clay and sand deposits in the area are commonly gypsiferous and waters are saline (fig. 8e).

Young faults in the Site 4 and 5 region are concentrated on the western side of the Tularosa structural basin (eastern base of the San Andres-Organ range--Seager, 1980, 1981). No young faults (<500,000 yrs) have been mapped in parts of the Jornada and Tularosa basins in or adjacent to Sites 4 and 5.

This study recommends that the lands in Sites 4 and 5 which are administered by the Department of Defense (White Sands Missile Range, McGregor-Fort Bliss-Range) be considered as viable candidates for possible low-level waste disposal sites. All of Site 5 is on DOD land, but it includes right-of-ways for U.S. Highway 54 and the Southern Pacific Railroad. About half of Site 4 is on White Sands Missile Range (table 3).

Koehler Area--figs. 7, 8f

The last area considered in this report is southwest of Raton near the town site of Koehler, a former coal-mining center in the Raton Basin. This area has many of the same hydrogeologic conditions present at Site 2. Cretaceous marine shale (Pierre Shale) is the dominant rock unit, and it is about 2000 ft thick at the Koehler locality. Land surface conditions are generally more stable than at the Prieta Site (table 4) and seismic risk appears to be low. A large body of good hydrogeologic information on the Pierre Shale has already been developed by Herkenhoff and Associates and Summers and Associates (1977). This work was done for Chem-Nuclear, Inc. as part of siting activity near Colfax (fig. 1) for a proposed low-level disposal facility. This locality is on the terraced terrain of the Vermejo river, a perennial stream 12 mi southwest of Koehler; because of present siting criteria, the Colfax area can not be considered as a viable site.

In contrast to the Chem-Nuclear site near Colfax the area near Koehler is situated at least 5 miles from floodplains of the two perennial streams, the Canadian and Vermejo Rivers. The siting criteria (table 2) also necessitated avoiding irrigated farmland (and associated canal systems) and ultimately limited the available area for a possible site to <2 mi^2. The proximity of residences, presence of the historic Santa Fe Trail route within the area, and its very small size indicate that the Koehler locality is probably not a viable site. However, in terms of geology, hydrology, and geomorphic and structural stability, the Koehler area compares quite favorably with the Prieta site (no. 2).

This case history is a good example of conflicts arising from varying interpretations of criteria guidelines (table 1 vs table 2). Many other professionals would probably rate the

Koehler locality as one of the best in the state; and it is here recommended that the Raton basin not be completely eliminated from future siting considerations.

CONCLUSION

This report to the Radioactive Waste Consultation Committee of the New Mexico State Legislature conforms with provisions of the 1981 "Site Identification Act" requiring 1) identification of at least three possible sites for a disposal facility for low-level waste generated in this state and 2) a report on identified sites to the committee and to the first session of the thirty-sixth legislature.

It is hoped that the methodology developed for conducting this study will be useful to other professional workers involved in site selection. This methodology includes the criteria (table 2), matrix format for site description (tables 3 to 6), and design of hydrogeologic cross sections (fig. 8a-f).

As previously stated, this state-of-the-art effort represents an early phase of the site selection process. The wide range of factural and speculative material presented in the report should receive immediate public and professional scrutiny. Perfect natural repositories for hazardous materials do not exist, nor are there perfect engineering or scientific solutions to the diversity of disposal problems. However, feedback from all sectors of society should promote the ultimate selection of best possible areas for processing, storage, and disposal of hazardous wastes, both radioactive and nonradioactive.

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Table 1. NATIONAL AND REGIONAL SITING CRITERIA FOR SHALLOW LAND BURIAL OF LOW-LEVEL RADIOACTIVE WASTE

1a. 10CRF 61 SITE SUITABILITY CRITERIA

1. The disposal site shall be capable of being characterized, modeled, analyzed and monitored.
2. Within the region or state where the facility is to be located, a disposal site should be selected so that projected population growth and future developments are not likely to affect the ability of the disposal facility to meet performance objectives
3. Areas must be avoided having economically significant natural resources which, if exploited, would result in failure to meet the performance objectives
4. The disposal site must be generally well drained and free of areas of flooding or frequent ponding. Waste disposal shall not take place in a 100-year flood plain, coastal high-hazard area or wetland.
5. Upstream drainage areas must be minimized to decrease the amount of runoff which could erode or inundate waste disposal units
6. The disposal site must provide sufficient depth to the water table that ground water intrusion, perennial or otherwise, into the waste will not occur
7. Any groundwater discharge to the surface within the disposal site must not originate within the hydrogeologic unit used for disposal
8. Areas must be avoided where tectonic processes such as faulting, folding, seismic activity, or vulcanism may occur with such frequency and extent to significantly affect the ability of the disposal site to meet performance objectives or may preclude defensible modeling and prediction of long-term impacts
9. Areas must be avoided where surface geologic processes such as mass wasting, erosion, slumping, landsliding, or weathering occur with such frequency and extent to significantly affect the ability of the disposal site to meet performance objectives or may preclude defensible modeling and prediction of long-term impacts
10. The disposal site must not be located where nearby facilities or activities could adversely impact the ability of the site to meet performance objectives or significantly mask the environmental monitoring program

1b. PERFORMANCE OBJECTIVES, WASTE-MANAGEMENT ASSUMPTIONS, AND RECOMMENDED SITING CRITERIA (FALCONER AND OTHERS, 1982)

Performance Objectives

1. The annual dose from radionuclides released from any shallow land burial site to persons outside the site boundary shall not exceed 25 mrem/yr--thyroid, 25 mrem/yr--any organ, for a performance period of 500 years.
2. Waste shall not be disposed of in a shallow land burial site that would result in an unacceptable dose to an inadvertent intruder after an institutional control period of 100 years has ended.

Assumptions about Waste Management Systems

1. The site will be selected, designed, operated and closed to meet performance objectives. Zero release is not achievable.
2. Performance objectives can be met by utilizing both natural and engineered barriers.
3. After the institutional control period, the site will be suitable for normal surface use but will not be designed to prevent human excavations into the waste.
4. Waste form will not jeopardize site performance.

Site Selection Criteria

1. The site should be of sufficient area and depth to accommodate the projected volume of waste and a three dimensional buffer zone.

    To meet site performance objectives for low-level radioactive waste disposal, the site and its operation must not limit the activity of man beyond site boundaries. A three-dimensional buffer zone will allow waste attenuation within the site boundary such that performance objectives are met. The essential information required to determine outer boundaries of the site (i.e., the buffer zone) includes the rate of change of radionuclide concentration as a function of distance from the disposal facility along all migration pathways and the concentration and quantity of radionuclides in the waste source. The depth to which the buffer zone extends depends on the hydrologic, geologic, and climatic setting of the disposal facility and whether waste is buried in unsaturated or saturated materials.

    In environments where infiltration does not reach the zone of saturation, such as areas where evapotranspiration plus runoff equal or exceed precipitation, solutes dissolved from upper soil horizons are deposited in a zone of accumulation. Material leached from the waste would be deposited in the zone of accumulation and would not reach the saturated zone. Between the zone of accumulation and the capillary fringe is a zone of low geochemical activity. The buffer zone boundary could be in this inactive zone if sufficient leeway is allowed for potential climatic changes or enhanced infiltration through the disposal trenches.

    In very arid climates, little or no water is available for leaching, and a thick zone of low geochemical activity separates buried waste from an underlying saturated zone. This environment would present a minimal probability of release by ground-water pathways, and the lower buffer zone boundary could be placed at a moderate distance below the disposal horizon.

2. The site should allow waste to be buried either completely above or below the transition zone between the unsaturated and saturated zones.

    The reliability of performance prediction may be significantly decreased by burial of waste in the transition zone and greater radionuclide release rates may result from the increased geochemical activity associated with this zone. To determine compliance with this criterion, it is necessary to examine the water table elevation, the range of both seasonal and long-term water-table fluctuations, height of the capillary fringe, thickness of excavatable material, and, if waste is buried below the transition zone, the hydraulic characteristics of earth materials in the saturated zone.

3. The site should be located where flooding will not jeopardize performance.

Where burial occurs above the water table, flood waters can transport waste material and/or saturate the waste, increasing leachate formation and accelerating subsurface water flow. Flooding can also interfere with site operations irrespective of the zone of burial. Locating burial sites outside areas that require extensive engineered protection will ensure that no increase in the probability of flooding occurs during the performance period of the site because of failure of engineered barriers.

4. The site should be located where erosion will not jeopardize performance.

During the required performance period of the site, erosion by wind and water must not cause intrusion on the buffer zone and/or waste cover such that it (a) uncovers the waste, (b) increases surface radiation levels above regulatory limits, and/or (c) significantly shortens radionuclide release pathways. Waste that is uncovered is susceptible to transport from the site, but erosion does not have to uncover the waste to significantly shorten migration pathways. During closure, certain engineered structures, such as trench caps, will likely be emplaced to improve waste containment. Erosion of these emplaced structures could decrease the performance capabilities of the site. Allowances for predicted rates of erosion during the site performance period should be incorporated into site design, operating, and closure criteria.

Plant cover and moisture availability are the most important factors governing the rate of erosion by both wind and water. Where average annual precipitation is very low, natural vegetation may be sparse or absent, allowing high wind erosion rates and high water erosion rates whenever precipitation does occur.

5. The site should be located in areas where hydrogeologic conditions allow reliable performance prediction.

Confident characterization of the hydrogeologic system in which a waste disposal site is located enables determination of potential migration pathways, estimation of radioactive contaminant movement rates in the subsurface environment, and design of a monitor network to collect data that can be used to confirm performance predictions of radionuclide transport. Major hydrologic characteristics of the site that must be examined include: subsurface geology, hydrologic budget, direction and magnitude of ground-water flow, permeability type and diffusion and dispersion properties of the system.

6. The site should be located where geologic hazards will not jeopardize performance.

Significant land disturbances may destroy site integrity and increase the likelihood of radionuclides entering the biosphere. In addition, site hydrology may be altered to the extent that performance predictions are no longer applicable. Specific geologic events that must be considered include earth movement associated with seismic activity, mass movement, land subsidence, and volcanic activity. The results of these events in the geologic past may so complicate the hydrogeologic system that predictions of site performance cannot be confidently obtained.

7. The site should be selected with consideration given to those characteristics of earth materials and water chemistry that favor increased residence times and/or attenuation of radionuclide concentrations within site boundaries.

Leachate migrating from buried wastes may carry radionuclides and other contaminants picked up from the waste. Slowing the movement of contaminants relative to the movement of water will provide more time for radioactive decay to decrease radionuclide concentrations. Properties of earth materials and water chemistry that favor the removal of radionuclides from solution by sorption or precipitation and that favor retention on or in solid phases, will retard the movement of radionuclides. Nuclide concentration will decline more rapidly with distance from the waste if geochemical processes actively remove radionuclides from leachate than if only hydrodynamic dispersion is acting.

8. The site should be selected with consideration given to current and projected population distributions.

The minimum distance a site can be located from a population cluster must be determined by considering the size of the population and the effects of potential accidental and chronic radiation releases during operations. A site located close to population centers could interfere with their expansion, as well as increase the likelihood of human intrusion into the waste after institutional control has ended.

9. The site should be selected with consideration given to current and projected land use and resource development.

Site selection must represent a balanced choice in land use, in that siting represents a commitment in land use to future generations. Historical, current, and potential land uses at the site and the adjacent areas should be prime considerations in complying with this criterion. Land uses which represent a higher priority in comparison to low-level waste disposal should be evaluated.

10. To the extent consistent with other criteria, the site should be selected with consideration given to location of waste generation, access to all-weather highway and rail routes, and access to utilities.

A certain risk exists from the transport of radioactive waste from points of generation to final disposal. This risk is a function of the waste form, nuclide content, vehicle safety, transportation systems, and distance traveled. By considering major points of waste generation and transportation routes in site selection, this risk can be reduced. Locating a site with regard to waste generators and transportation systems also minimizes the cost of land disposal. Additional economic factors that can be controlled through site selection include access to utilities, materials for site construction, operation and closure, and public services.

11. The site should be selected consistent with federal laws and regulations.

Federal laws that a disposal site must comply with include but are not limited to: Clean Air Act (PL 95-95), Federal Water Pollution Control Act (PL 95-217), Safe Drinking Water Act (PL 93-523), National Environmental Policy Act (PL91-190).

12. The site should not be located within areas that are protected from such use by federal laws and regulations.

Federal laws which preclude, by intent, the selection of low-level waste disposal sites within the boundaries of areas protected under them include but are not limited to: Wilderness Act of 1964 (PL 88-577), Wild and Scenic Rivers Act (PL 90-542), Endangered Species Act of 1973 (PL 93-205), National Wildlife Refuge Act of 1966 (PL 89-669), Laws establishing National Parks, Historic Properties-Preservation (PL 89-665), Archeological and Historical Preservations Act of 1974 (PL 93-291).

TABLE 2. GEOLOGIC AND HYDROLOGIC SITING CRITERIA FOR LOW-LEVEL WASTE DISPOSAL IN NEW MEXICO

I. The most important goal in waste disposal is to prevent contamination of surface and ground waters and the atmosphere. Key to achieving this goal is to prevent the uncontrolled release of fluid, gaseous, and particulate wastes at a disposal facility. Meteoric water must be precluded from entering a containment facility and leachate must not be allowed to leak from the facility. The wastes must be isolated from the atmosphere and biosphere, as well as from surface and subsurface hydrologic systems. A thorough understanding of the local and regional environmental setting is needed to accomplish the desired isolation and assure long-term site stability.

II. Land, Mineral and Energy Resources.

Sites should not be located in areas where future natural resource development could adversely affect site integrity. Potential activities include irrigation agriculture, mineral extraction, and geothermal energy development (Anderson and Maker, 1974; Siemers and Austin, 1979; U.S. Geological Survey, 1981; Summers, 1979).

III. Surface Processes

Geomorphic processes that adversely affect site stability, and landforms or surficial deposits that indicate various degrees of surface stability must be thoroughly evaluated. The site should be in a physiographic position naturally resistant to water and wind erosion, flooding, mass wasting or subsidence (Hawley and Love, 1981; Nyhan and Lane, 1982; Wilson, 1973; Holzer and Pampeyan, 1981).

A. Climate-process considerations:

1. Sites should be located in arid and semiarid areas with low local relief.

2. Mean annual precipitation should not exceed 425 mm (16 in), with 24-hr storm intensities no greater than 200 mm (8 in).

3. Annual evaporation (Class A pan) should be at least 60 in .

4. Surficial materials and natural vegetation cover should inhibit wind erosion (deflation).

B. Slopes and other topographic factors associated with limited erosion-sedimentation rates:

1. Local relief should be low (elevation range of less than 300 ft in an area of less than 36 square miles)

2. Natural slopes should be ≤5%.

3. Where slopes are very low (<1%), they should not be susceptible to flooding or ponding from storm runoff. Avoid all floodplains and lake plains.

4. Avoid areas of active erosion-sedimentation, including areas of thick alluvial and eolian deposits of Holocene age (10,000 yrs).

5. Distance to very steep slopes such as rim zones of escarpments should exceed 1 mile.

6. Surficial geologic units should not contain deposits emplaced by mass wasting, such as landslide and debris-flow units.

C. Soil-geomorphic factors. Sites should be on stable geomorphic surfaces where absolute age-dating techniques and soil-profile characteristics (strong pedogenic horizons of carbonate and clay accumulation) indicate that surface ages exceed 10,000 years.

IV. Geologic Structure and Volcanic Features

The geologic structure should be simple enough to be well understood and evaluated in terms of site suitability. A thorough investigation is needed to reveal the presence of faulting, folding, and jointing in the general site area.

A. Avoid areas of major tectonic deformation (e.g. complexly folded and faulted rocks associated with rugged terrain).

B. Site should be at least 1 mile from known faults with movement during the past 500,000 years (Machette, 1982; Seager, 1980).

C. Site should be at least 1 mile from volcanic centers with known activity during the past 500,000 years.

D. Avoid areas with major historical seismic activity (local magnitude, M_L, ≥4), or anomalous vertical crustal movements. See Sanford and others (1981), and Reilinger and others (1979).

E. Avoid areas with anomalous terrestrial heat flow. See Reiter and others, (1979).

TABLE 2 (continued)

V. Geohydrology

Ground and surface water must be protected from contamination by low-level wastes or waste byproducts (Wilson, 1979, 1981). Protection of aquifers—geologic materials that contain recoverable water of suitable quality for human consumption--is of primary importance. Aquifers are characterized by minimum well yields in the 1 to 10 gpm range, and water quality is in the fresh (<1,000 mg/L total dissolved solids-TDS) to slightly saline (1,000-3,000 mg/L TDS) range. (Saline water exceeds 3,000 mg/L TDS.)

1. The preliminary evaluation of possible site areas should include determination of depth to water table or piezometric surface; direction of groundwater flow; distribution of aquifers and confining beds; and nature of major geochemical components of the flow system.
2. The site should be at least 5 miles from the maximum floodplain or lake shoreline of perennial surface waters.
3. The site should be at least 5 miles from any well or spring tapping a major aquifer (minimum yield 100 gpm of fresh water).
4. Where unconfined ground-water conditions exist, the water table should be at least 300 feet below the surface.
5. If the unsaturated zone is less than 500 ft thick, at least 150 feet of clay-rich, relatively impermeable materials should be present between the surface and any potential aquifer. Recommended hydraulic conductivity values for clay-rich materials should not exceed 10^{-7} cm/sec (e.g. under unit head fluids would migrate 0.1 ft/yr or less).
6. Where relatively impermeable, clay-rich materials extend from the surface (or near-surface) into the saturated zone, confined ground-water conditions usually exist; and it is often impossible to determine unconfined "water-table" configurations. Piezometric surfaces associated with underlying confined aquifers should be at least 300 feet below the land surface.
7. Major areas of the state where unsaturated zones exceed 500 ft in thickness should get special scrutiny for possible disposal sites.
8. Areas of the state with known "dry hole" water tests in thick, clay-rich units should also receive special attention.
9. Areas where ground-water flow is primarily through fractures or solution-enlarged conduits should be avoided.

VI. Hydrogeologic Settings for Waste Repositories

A. Site areas underlain by fine-grained marine rocks. Clay-rich marine rocks (shales, claystones, mudstone) locally have good potential as host materials. Smectite-type clay minerals with large ion-adsorptive and expansive properties, are major constituents. Units are very impermeable and commonly saturated or nearly saturated with saline water. (Type I material of Longmire and others, 1981.)

Representative formations:

1. Pierre Shale and Smoky Hill Marl Mbr-Niobrara Fm (Upper Cretaceous). More than 2,000 ft thick in parts of Colfax County southwest of Raton (fig. 8f).
2. Mancos Shale (Upper Cretaceous) as much as 1200 ft thick in parts of San Juan Basin-Colorado Plateau (fig. 8b).

B. Site areas underlain by basin and valley fill. Sand, silt, clay and gravel (unconsolidated to partly indurated); locally thousands of feet thick. Exhibits wide range in texture and geochemical properties (e.g. lake clay, dune sand, gravelly fan alluvium, and river sand and gravel). (Type II material of Longmire and others, 1981). Representative units include:

1. Ogallala Fm. Upper Miocene alluvial and eolian deposits on the High Plains. This major aquifer is unsuited for waste repositories of any type.
2. Santa Fe Group. Major fill unit of intermontane basins in central and southern New Mexico. River and stream deposits of late Miocene to middle Pleistocene age form major aquifer. Clay-rich, partly-saline and zeolitic, lake and playa deposits locally make up large part of unit in bolson-floor areas (e.g. sites 4 and 5, figs. 1 and 7). Unit ranges up to 16,000 feet thick in parts of the central Albuquerque Basin where it constitutes one of the great aquifers of the nation. Interbedded sand, silt, clay and gravel of the Santa Fe Group also underlie the extensive Llano de Albuquerque tableland situated between the Rio Grande and Puerco valleys. In that area the unsaturated zone is as much as 1,000 ft thick (site 1, figs. 1 and 7).

C. Site areas underlain by older continental deposits. Shale, mudstone, siltstone and sandstone (in places poorly consolidated); locally several thousand feet thick. Unit includes stream and lake deposits of early to middle Tertiary age in the Colorado Plateau and Basin and Range Provinces. (Type III materials of Longmire and others, 1981). Representative units include:

1. Nacimiento Fm. Lower Tertiary alluvial and lacustrine unit in the San Juan Basin that is primarily shale, but which locally contains lenticular, water-bearing sandstone beds (site 3, figs. 1 and 7).
2. Clay- to sand-rich clastic deposits, commonly zeolitic; primarily conglomeratic debris-flow units and mudstones associated with middle Tertiary volcanic terranes of southwestern New Mexico (e.g. Spears, Palm Park, Rubio Peak Fms). Unit may prove to be important host rock for waste repositories.

TABLE 3. INSTITUTIONAL AND CULTURAL FEATURES AT FEASIBLE SITES FOR LOW-LEVEL WASTE DISPOSAL

SITE NUMBER	1	2	3	4	5	Unrated
COUNTY	Bernalillo	Sandoval	San Juan	Doña Ana	Otero	Colfax
SITE NAME	Llano de Albuquerque	Prieta	Huerfano	Jornada	Desert	Koehler
QUADRANGLE(S)	Albuquerque 2° Volcano Ranch 7-1/2' Sky Village NE 7-1/2'	Albuquerque 2° Ojito Spring 7-1/2' Cabezon Peak 7-1/2' San Luis 7-1/2'	Aztec 2° Bloomfield 15' Huerfano Trad. Post NW Huerfano Trad. Post 7-1/2'	Las Cruces 2° Chicken Well 15' Naylor Mtn 15'	Las Cruces 2° Elwood 7-1/2' Orogrande S 7-1/2'	Raton 2° Koehler 7-1/2'
TOWNSHIP/ RANGE/ SECTION	10N/1E/1,2 11N/1E/10,11,14,15,22, 23,25,26,35,36 12N/1E/21,22,27,28	15N/1W/6,7 15N/2W/1,12 16N/1W/18,19,30,31 16N/2W/13,14,23-26,36 17N/2W/7	26N/10W/10,11,14,15,22, 23,26,27,34,35	17S/2E/20-29,32-36 18S/2E/1-5,8-12	23S/8E/3-5,8-10, 15-17,20-22, 28-30,31-33	
LAND GRANT-LONGITUDE/ LATITUDE	Town of Alameda	Formerly part of Ojo de Espiritu Santo Grant				Maxwell 104°33-35' Long 36°42-43' Lat
SITE AREA	>10 mi², 3 parcels	10 mi² (30 mi²)	10 mi²	25 mi²	36 mi²	<2 mi²
LAND OWNERSHIP	Private State (10/1/2,11/1/36)	Public (BLM)	Public (BLM)	DOD (WSMR) 13 mi² Public (BLM) 11 mi² State (17/2/32)	DOD (McGregor Rge Fort Bliss)	Private
MAJOR LAND USES	Grazing Land Suburban Expansion	Grazing Land Gas Pipeline	Grazing Land Gas Pipeline 4 gas/oil wells	Grazing Land WSMR (Buffer zone)	Military, Highway and RR right-of-way	Grazing Land
ESTIMATED DISTANCE TO NEAREST:						
Town	3-6 mi (suburban Albuquerque)	12 mi (San Ysidro)	15 mi (Bloomfield)	20 mi (Rincon)	3-15 mi (Orogrande)	12 mi (Raton, Maxwell)
Residence	Several on or near site	3 mi	1-5 mi	1-5 mi	3-15 mi	1 mi
Perennial Stream	6-11 mi (Rio Grande)	12 mi (Jemez River)	13-18 mi (San Juan River)	17-23 mi (Rio Grande)	30-42 mi (Rio Grande)	5 mi (Canadian River)
Lake or Reservoir (downstream)	20-25 mi (Rio Grande floodplain)	23 mi (Jemez Reservoir)	NA	NA	NA	8 mi (Maxwell Natl. Wildlife Refuge)
Irrigated Farm Land	6-11 mi	13 mi	5-18 mi (Navajo Irrig. Proj.)	17-23 mi	15-25 mi	5 mi
Interstate Highway	4-12 mi (I-40)	29 mi (I-25)	80 mi (I-40)	15-21 mi (I-25)	25-36 mi (I-25)	4-5 mi (I-25)
Federal/State Hwy.	4-12 mi	5 mi (NM-44,NM-279)	<4 mi (NM-44)	20 mi	0-4 mi (US-54)	1-2 mi (US-64)
Railroad	8-13 mi	29 mi	80 mi (ATSF)	15-21 mi (ATSF)	0-4 mi (SP)	4-5 mi (STSF)
ARCHAEOLOGICAL(A)/ HISTORICAL(H)/ CULTURAL SITES (C)	A-on site C-Albuquerque volcanoes, 1-7 mi	A-on site C-Cabezon Peak Wilderness Study Area, 2-5 mi	A-on site	A-on site	A-on site	A-on site H-Santa Fe Trail on site; near Koehler townsite
REMARKS	Area may be expanded to north and south	Area may be expanded north into San Luis Quad (T16-17N,R2W)			Area constrained because of highway and railroad right-of-ways	Area may be considered at later date
KEY REFERENCES	Bjorklund and Maxwell (1961); Black (1982); Black and Hiss (1974); Hacker (1977); Hawley et al. (1982); Kelley (1977); Lambert (1968); Machette (1978, 1982); Black and Campbell (1976); Titus (1961)	Baltz (1978); Black and Hiss (1974); Craigg (1980); Kelley (1977); Maker et al. (1971a); Molenaar (1974); Black and Campbell (1976); Woodward and Martinez (1974)	Baltz (1967); Brimhall (1972); Fassett and Hinds (1971); Hoetch (1980); Maker et al. (1973); Parker et al. (1977); Stone et al. (1983); Wells and Rose (1981)	Bulloch et al. (1980); Gile et al. (1981); King et al. (1971); Maker et al. (1971b); Seager et al. (1983); Wilson et al. (1981)	Derr (1981); Hoidale et al. (1967); Knoles and Kennedy (1958); Maker et al. (1972b); Seager (1980, 1981) Seager et al. (1983)	Anderson et al (1982); Baltz (1965); Griggs (1948); Herkenhoff and Assoc. (1977); Maker et al. (1972a)

TABLE 4. PHYSIOGRAPHIC FEATURES AT POSSIBLE SITES FOR LOW-LEVEL WASTE DISPOSAL

SITE NUMBER	1	2	3	4	5	
SITE NAME	L. de Albuquerque	Frieta	Huerfano	Jornada	Desert	Roehler
CLIMATOLOGICAL DATA Station (elevation)	Albuquerque (5314')	Cuba (6945')	Aztec (5648')	Las Cruces (3881')	Alamogordo (4350')	Springer (5857')
Precipitation (in) Mean Annual Maximum (24-hr)	7.9 4	13.8 <3.5	9.3 —	8.4 6.5 (8/30/35)	10.1 <6.5	15.6 6-7 (9/1/42)
Temperature (°F) Mean January Mean July	35 79	26 69	29 74	42 79	42 80	30 73
Evaporation (in) Class-A Pan (estimated)	75	—	68	97	100	73
Wind Conditions	Late winter-early summer high winds (dust)	Late winter-early summer high winds (dust)	Late winter-early summer high winds (dust)	Late winter-early summer high winds (dust)	Late winter-early summer high winds (dust)	Late winter-early summer high winds (dust)
PHYSIOGRAPHIC UNIT Province	Basin and Range	Colorado Plateau	Colorado Plateau	Basin and Range	Basin and Range	Great Plains
Section	Mexican Highland	Navajo	Navajo	Mexican Highland	Mexican Highland	Raton
GEOGRAPHICAL AREA	north-central Albuquerque Basin	upper Rio Salado (Jemez Rv.) basin	central San Juan Basin	east-central Jornado del Muerto Basin	SE Tularosa Valley N. Hueco Bolson	upper Canadian River Valley
ELEVATION RANGE (ft)	5000-6100	5800-6400	6550-6815	4500-5100	4060-4110	6300-6450
LANDFORMS Major	Summit of high tableland (mesa) flanked by river valleys	upland; SE slope of Rio Puerco-Salado drainage divide	summit of high tableland (mesa) flanked by stream valleys	piedmont slope grading from San Andres Mtns to floor of Jornada del Muerto basin, a closed intermontane basin (bolson)	Bolson floor, river and lake plains not yet integrated with Rio Grande Valley System	pediment, grading from Park Plateau escarpment to Canadian River Valley
Minor	shallow arroyo valleys, small closed depressions eolian sand sheets	shallow arroyo valleys, broad shale and narrow sandstone ridges	shallow arroyo valleys, eolian sand sheets, and low dune ridges	coalescent alluvial fans, shallow arroyo valleys	shallow deflation depressions, eolian sand sheets and dunes	shallow arroyo valleys, local shale ridges
LOCAL RELIEF (ft)	50-100	100-200	50-200	100	<2	50-150
SLOPE CHARACTER Range (major)	mostly <5% Locally up to 15%	mostly <10% Locally up to 25%	most <5% very locally up to 15%	mostly 2-3% very locally up to 15%	<1% except for coppice dunes	mostly 1-5% Locally up to 25%
Distribution	broad smooth upland, with fringing shallow valleys	gently sloping and undulating uplands with shallow valleys	broad undulating upland, with shallow valleys	uniform, broad piedmont slope, with shallow arroyos	irregular, many small steep dunes	gently-sloping footslope
Steep Terrain	narrow strips near arroyos	narrow strips near arroyos, cuesta scarps	narrow strips near arroyos	none	none	narrow strips near arroyos, cuesta scarps
DRAINAGE NETWORK Pattern	discontinuous, subparallel, few closed structural depressions	subparallel, irregular, bedrock control	disrupted by eolian deposits, subparallel	subparallel	essentially absent, many small deflation depressions	irregular, bedrock control
Density	low	moderate to high; low on divides	very low	low	extremely low	low to moderate; high on small cuestas

TABLE 4 (continued)

SITE NUMBER	1	2	3	4	5	
SITE NAME	L. de Albuquerque	Prieto	Huerfano	Jornada	Desert	[illegible]
SURFICIAL MATERIALS						
Genetic Classes	eolian/fluvial (deposits of major tributaries to ancestrial Rio Grande)	colluvial/alluvial (stream deposits on ancient erosion surface, and young valley fill)	eolian/alluvial (stream deposits on ancient erosion surface)	eolian/alluvial (coalescent alluvial-fan piedmont deposits)	eolian/fluvial and lacustrine (deposits of deltaic distributaries of ancestrial Rio Grande)	alluvial/colluvial (pediment veneer)
Lithologic Character	loam-sand (thin) with calcic soils, over sand and gravel	loam-silty clay (thin); over shale	clay loam-sand, locally pebbly, (<30'), over shale	loamy sand to pebbly loam	sand-loam with calcic soils, over clay or sand	silty clay-loam and sand (<10') over shale
Stratigraphic Units (age)	Late Quaternary sediments/upper Santa Fe Gp (Middle Pleistocene and older)	Late Quaternary sediments/ Cretaceous	Late Quaternary sediments/ Paleocene	Late Quaternary sediments/upper Santa Fe Gp (Middle Pleistocene and older	Late Quaternary sediments/upper Santa Fe Gp	Late Quaternary sediments/ Cretaceous
MAJOR SOILS Taxonomic Classes	haplargids, calciorthids, psamments	camborthids, orthents	haplargids, psamments	haplargids, psamments	haplargids, psamments	argiustolls, orthents, orthids
Association	Madurez-Wink	Las Lucas-Litle-Persayo	Doak-Sheppard-Shiprock	Onite-Pintura	Pintura-Dona Ana	[illegible], Mion-Litle
Engineering Classes (unified)	SC-SM, SM, CL	CL, ML	ML, CL, SP-SM	SM, SP-SM, SM-SC	SM-SC, SP-SM	CL, CH
Irrigation Potential	low to unsuited for cultivation	low to unsuited for cultivation	moderate	low to moderate	low to moderate	high, low
MAJOR VEGETATION	grasses and shrubs	grasses and shrubs	grass	shrubs and grass	shrubs-barren	grass
EROSION						
Water-erosion Hazards	slight to moderate	high to moderate	slight to moderate	moderate	low	moderate to high
Wind-erosion Hazards	moderate to severe	low to moderate	moderate to severe	high to severe	high to severe	moderate to low
STABILITY OF MAJOR GEOMORPHIC SURFACE	very stable; no significant soil loss for 100,000 to 300,000 yrs	unstable to moderately stable; many areas with erosion-sedimentation in past 10,000 yrs	stable; no significant soil loss for 100,000 yrs, extensive wind reworking of surface layers	constructional; minor deposition and no significant soil loss for 100,000 years	very stable; no significant soil loss for 500,000 years; extensive wind reworking of surface layers	moderately stable; large area stable for <25,000 years; local erosion-sedimentation in past 10,000 years in shale outcrop areas

TABLE 5. GEOLOGIC STRUCTURE AND HAZARDS, AND ENERGY AND MINERAL RESOURCES AT POSSIBLE SITES FOR LOW-LEVEL WASTE DISPOSAL

SITE NUMBER	1	2	3	4	5	6
SITE NAME	L. de Albuquerque	Prieta	Huerfano	Jornada	Desert	Koehler
STRUCTURE Major Tectonic Features	Rio Grande rift; intermontane basins; slightly tilted fault blocks	S. San Juan Basin; W. of Nacimiento fault zone; SW of Puerco fault zone	Central San Juan Basin	Rio Grande rift; intermontane basin; slightly tilted fault blocks	Rio Grande rift, intermontane basin; slightly tilted fault blocks	Central Raton Basin
Known Faults and Folds	High-angle normal faults	Broad folds, NW dipping homocline	Very gentle NNE dipping homocline	High-angle normal faults	High-angle normal faults	Very gentle NW dipping homocline
Distribution	Common, local	regional	regional	widely spaced	widely spaced	regional
Age	Pliocene-Holocene	Cenozoic		Pliocene-Pleistocene	Pliocene-Pleistocene	Cenozoic
Fault with Displacement in Past 500,000 Years	documented (Machette, 1982)	none noted	none	nearby areas to west and east	nearby areas to west and south	none
Distribution	Common 2-5 mi spacing			widely spaced	widely spaced	
Minimum Distance	1-2 mi			5-12 mi	6-12 mi	
Seismic Activity/Risk	$\geq$ moderate	moderate to high	moderate	$\geq$ moderate	$\geq$ moderate	moderate
Terrestrial Heat Flow	moderate to high	high to moderate	moderate	moderate to high	moderate	moderate
Volcanic Activity	Albuquerque Volcanoes basalt center<0.2 m.y. (1-6 mi)	Cabezon Neck, basaltic center 2.5 m.y. (4-5 mi)	none	none	none	Eagle Tail Mtn. basaltic center 3-4 m.y. (9 mi)
HAZARDS Distance to escarpments	>1 mi	>1 mi	>1 mi	>8 mi	>5 mi	1 mi
Mass Wasting	none	Noted on slopes of Mesa Prieta (>1 mi)	Noted on slopes of Huerfano Peak (>1 mi)	none	none	Noted on slopes of Park Plateau escarpment (>1 mi)
Land Subsidence	none	none	none	none	none	none
Earth Fissures	none	none	none	none	none	none
MINERAL AND ENERGY RESOURCES						
Oil and Gas	no producers nearby	no producers nearby	present	no producers nearby	no producers nearby	no producers nearby
Wells	recent tests	early tests	4 producers	recent tests	early tests	early tests
Resource Potential	probable	possible	excellent	possible	possible?	possible?
Coal	none	none	none	none	none	mining at Koehler (3 mi)
Uranium	none	possible	none	none	none	none
Geothermal Energy	possible?	possible	none?	possible?	possible?	none
Metals	none	none	none	none	none	none
Industrial Minerals	?	clay (shale)	none	none	clay	clay (shale, marl)
Aggregate Materials	sand and gravel	none?	none?	none?	sand and gravel	none?

TABLE 6. HYDROGEOLOGIC FEATURES AT POSSIBLE SITES FOR LOW-LEVEL WASTE DISPOSAL

SITE NUMBER	1	2	3	4	5	
SITE NAME	L.de Albuquerque	Prieta	Huerfano	Jornada	Desert	Kerbler
GENERAL SUBSURFACE CONDITIONS	"Type II"unit: unconfined basin-fill aquifer below very thick vadose zone; few deep wells	"Type I" unit: thick marine shale;no major aquifer."Dry hole" near Site(13/2/3.43)	"Type III" unit: fine-grained continental rocks over deep,confined sandstone aquifer; no well	"Type II"unit: thin unconfined basin-fill aquifer below thick vadose zone; 1 well	"Type II" unit: no known aquifer below thick clay-rich vadose zone. "Dry hole"near Site(25/8/6.33).	"Type I" unit: thick marine shale, no major aquifer present; no well on site
UNSATURATED ZONE (VADOSE ZONE)	area >200 mi^2	partly-saturated shale	area >50 mi^2	area ~25 mi^2	area >100 mi^2	partly-saturated shale
Thickness Range(ft)	800-1000	thin?	300-550	500-700	~300	thin?
Stratigraphic Units	Santa Fe Group	thin valley-fill alluvium/ Mancos Shale	thin eolian and alluvial deposits/ Nacimiento Fm.	Santa Fe Group, with thin alluvial and eolian veneer	Santa Fe Group (upper),with thin eolian veneer	thin pediment and valley-fill alluvium/ Pierre Shale
Lithologic Character	interbedded sand, clay, and silt; with some gravel in upper 200 ft	shale,with siltstone,mudstone,and thin sandstone, sand and clay	shale, with lenticular sandstone beds, and thin loamy sand deposits	interbedded sand, silt,and clay; with gravelly zones in upper 300 ft	clay, with some interbedded sand	shale, with marl, limestone and siltstone, and thin sand and clay
Geochemical Properties	montmorillonitic clay, zeolitic? silt and sand	montmorillonitic shale, locally saline	montmorillonitic shale	montmorillonitic and zeolitic clay and silt; gypsiferous sand-clay	montmorillonitic and zeolitic clay and silt; gypsiferous clay-sand	montmorillonitic shale, locally saline
Hydrology Soil moisture	permantly deficient at depth in most areas; evapotranspiration high	as at Site 1	as at Site 1, local and transitory saturation zones below sand dune tracts	as at Site 1	as at Site 1	as at Site 1
Recharge areas	small size, limited to arroyos and playa basins	small size, limited to arroyos	small size, limited to arroyos and deep sand areas	small size, limited to arroyos	small size, limited to deeper deflation basins	small size, limited to arroyos
"Perched" Water tables	not noted	occur locally in basal valley fills and weathered shale zones	occur locally in sandstone lenses and basal alluvial fills	not noted	not noted	occur locally in basal valley fills and weathered shale zones
SATURATED ZONE-UNCONFINED AQUIFERS	major aquifer at great depth east of site	thick shale interval (see above)	limited to sandstone lenses below 300 ft	minor aquifer, thin,locally saline	minor aquifer at depth SW of site	thick shale interval (see above)
Stratigraphic Unit	Santa Fe Group		Nacimiento Fm.	Santa Fe Group	Upper Santa Fe	
Lithologic Character	interbedded sand,silt, clay, and minor basalt	—	fine-grained sandstone	interbedded sand and clay	interbedded sand and clay	—
Geochemical Properties	fresh to slightly saline water; minerals as in vadose zone	—	fresh to slightly saline water	slightly saline water; minerals as in vadose zone	slightly saline to saline water; minerals as in vadose zone	—
Water Table Depth (ft)	700-1000 slighty below Rio Grande level; rises steeply to west	—	discontinuous ~300	583-730	~550	—
Flow Dynamics	long southward flow path (subparallel to Rio Grande Valley)--25-50 mi to river	—	long northward flow path to San Juan River Valley--13-18 mi to river	long westward flow path to Rio Grande Valley--20-25 mi to river	long southward flow path to Rio Grande Valley--30-50 mi to river	—
SATURATED ZONE-CONFINED AQUIFERS Stratigraphic Unit	—	—	Important regional aquifer Ojo Alamo Ss	—	—	—
Lithologic Character	—	—	sandstone, with some siltstone and shale	—	—	—
Geochemistry	—	—	fresh water	—	—	—
Confining Beds	—	—	Nacimiento Fm	—	—	—
Piezometric Surface	—	—	400-500 ft depth	—	—	—
Flow Dynamics	—	—	northward to San Juan Valley	—	—	—

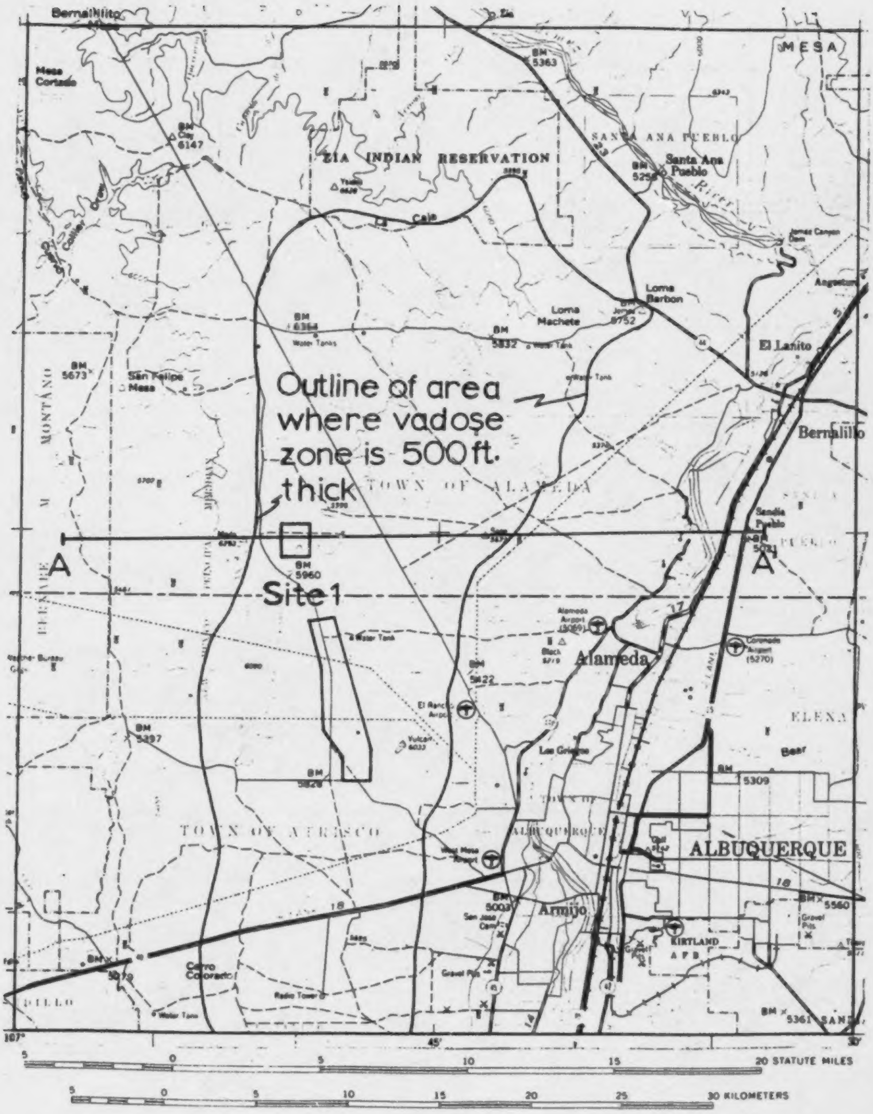

Bernalillito Mesa
Mesa Cortada
BM 5363
MESA
ZIA INDIAN RESERVATION
SANTA ANA PUEBLO
Santa Ana Pueblo
BM 6147
Loma Barbon
Loma Machete
BM 6364
BM 5832
El Lanito
Bernalillo
BM 5673
San Felipe Mesa
MONTANO
Outline of area where vadose zone is 500 ft. thick
TOWN OF ALAMEDA
A
A'
BM 5960
Site 1
Sandia Pueblo
Alameda Airport
Alameda
Coronado Airport (5270)
BM 5622
El Rancho Airport
BM 5297
BM 5309
ELENA
BM 5828
Los Griegos
TOWN OF ATRISCO
ALBUQUERQUE
West Mesa Airport
BM 5003
Armijo
BM 5560
KIRTLAND A F B
Cerro Colorado
BM 5079
Radio Tower
BM 5361
Gravel Pits
107°
45'
30'
5 0 5 10 15 20 STATUTE MILES
5 0 5 10 15 20 25 30 KILOMETERS

Figure 2. Index map to Site 1 area (Llano de Albuquerque) and location of section AA'

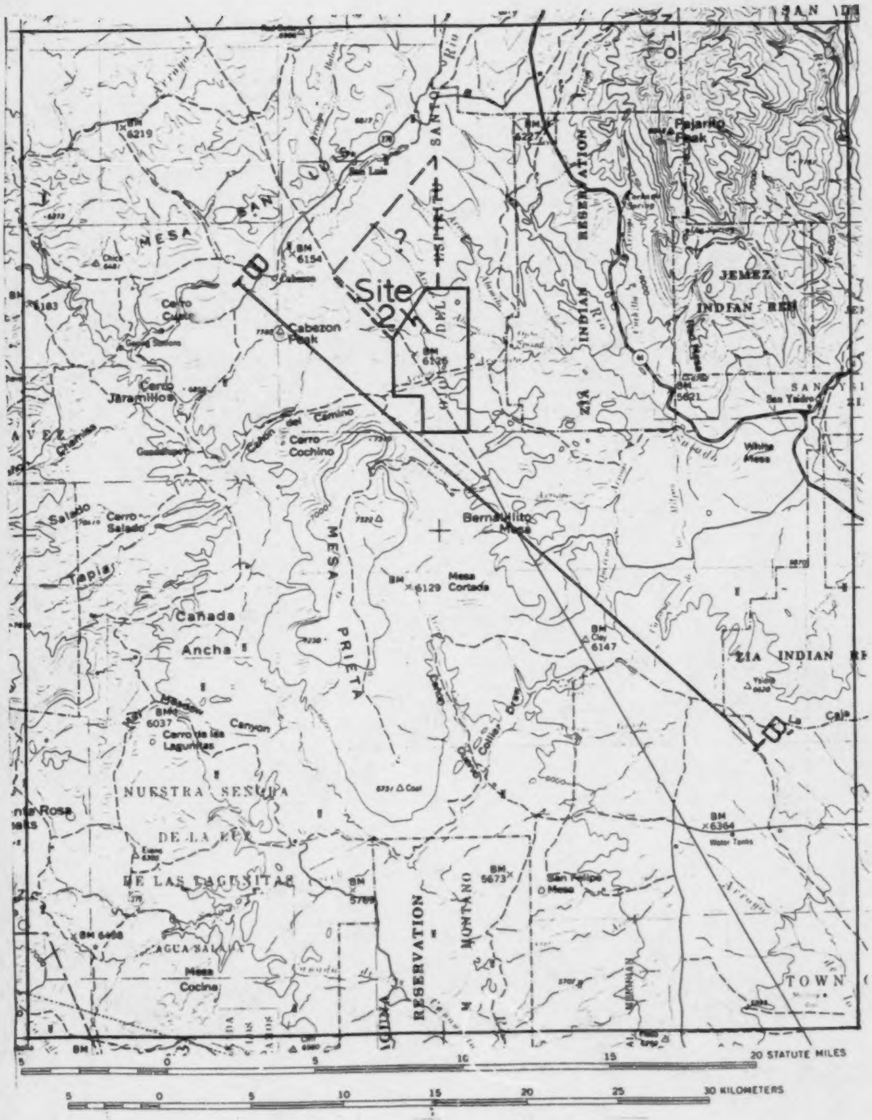

Site 2
?
B
B'
MESA
SAN
Cabezon Peak
Cerro Cuate
Cerro Jaramillos
Cerro Cochino
Canon del Camino
Guadalupe
Cerro Salado
Salado
Tapia
Canada Ancha
MESA PRIETA
Bernalillito Mesa
Mesa Cortada
BM 6129
BM 6147
BM 6037
Cerro de las Lagunitas
Canyon
NUESTRA SENORA DE LA LUZ DE LAS LAGUNITAS
AGUA SALADA
Mesa Cocina
RESERVATION
MONTANO
San Felipe Mesa
BM 5673
BM 6364
Water Tanks
TOWN
ZIA INDIAN R
ZIA INDIAN RESERVATION
JEMEZ INDIAN RES
Pajarito Peak
White Mesa
San Ysidro
BM 5621
BM 6219
BM 6154
BM 6126
San Luis
Cabezon
La Ceja
20 STATUTE MILES
30 KILOMETERS

Figure 3. Index map to Site 2 area (Prieta) and location of section BB'

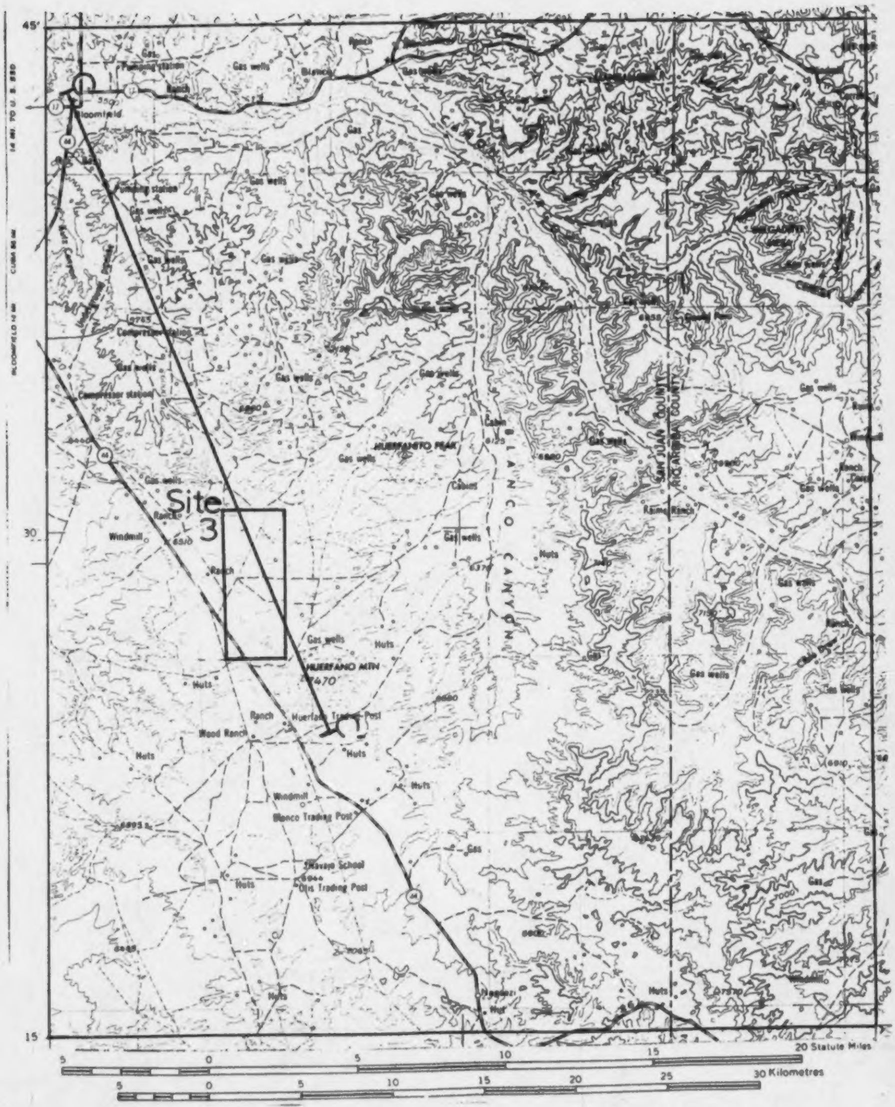

45'
30
15
Bloomfield
Pumping station
Gas wells
Compressor station
Site 3
Windmill
Ranch
HUERFANITO PEAK
HUERFANO MTN
7470
Huerfano Trading Post
Wood Ranch
Huts
Blanco Trading Post
Navajo School
Otis Trading Post
BLANCO CANYON
SAN JUAN COUNTY
RIO ARRIBA COUNTY
5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometres

Figure 4. Index map to Site 3 area (Huerfano) and location of section CC'

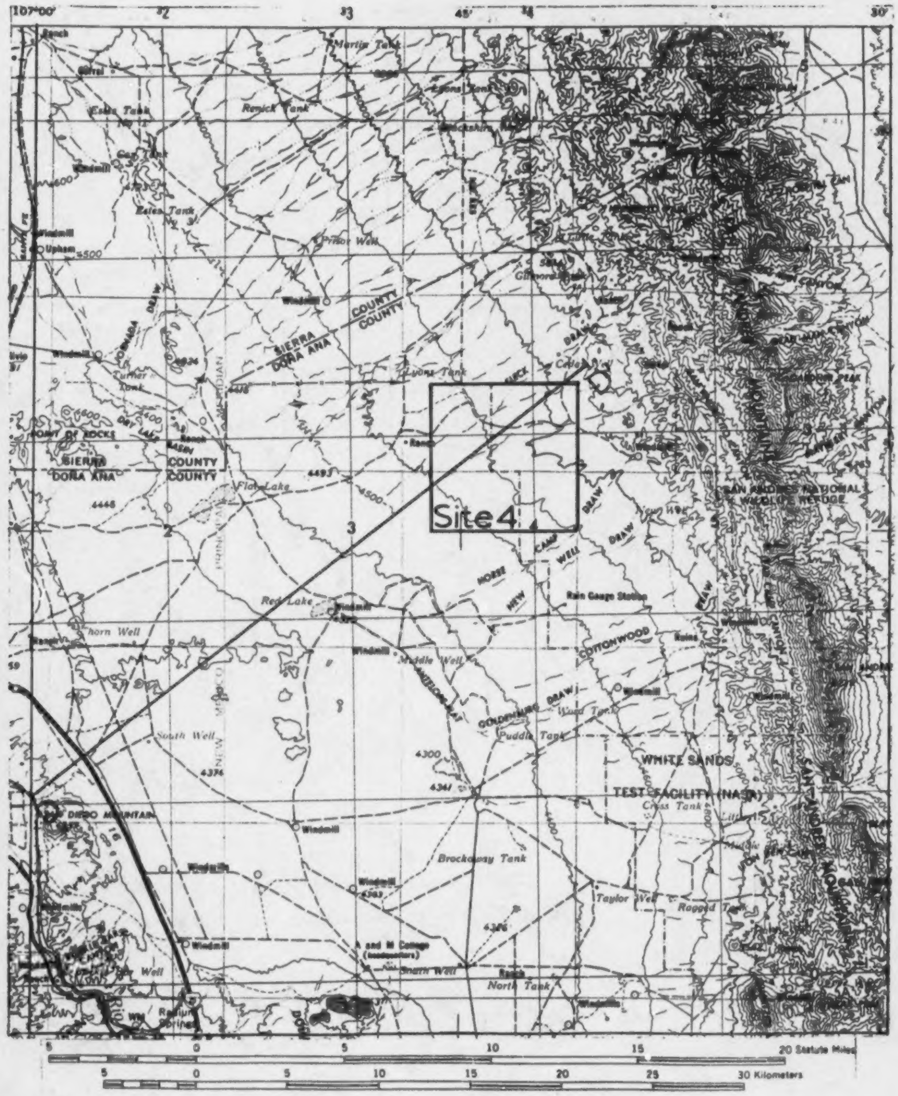

107°00'
32
33
45'
34
30'
Site 4
SIERRA
DOÑA ANA
COUNTY
COUNTY
Flat Lake
Red Lake
Middle Well
South Well
Lyons Tank
Prisor Well
Renick Tank
Martin Tank
Turner Tank
Eslea Tank
Windmill
Upham
Ranch
POINT OF ROCKS
HORSE CAMP DRAW
NEW WELL DRAW
Rain Gauge Station
COTTONWOOD DRAW
Puddle Tank
WHITE SANDS TEST FACILITY (NASA)
Cross Tank
Brockaway Tank
Taylor Well
Ragged Tank
A and M College
North Tank
Smith Well
SAN ANDRES NATIONAL WILDLIFE REFUGE
SAN ANDRES MOUNTAINS
DOÑA ANA MOUNTAINS
NEW MEXICO
PRINCIPAL MERIDIAN
Radium Springs
4300
4341
4376
4403
4446
4493
4500
4600
2
3
5
0
5
10
15
20 Statute Miles
5
0
5
10
15
20
25
30 Kilometers

Figure 5. Index map to Site 4 area (Jornada) and location of section DD'

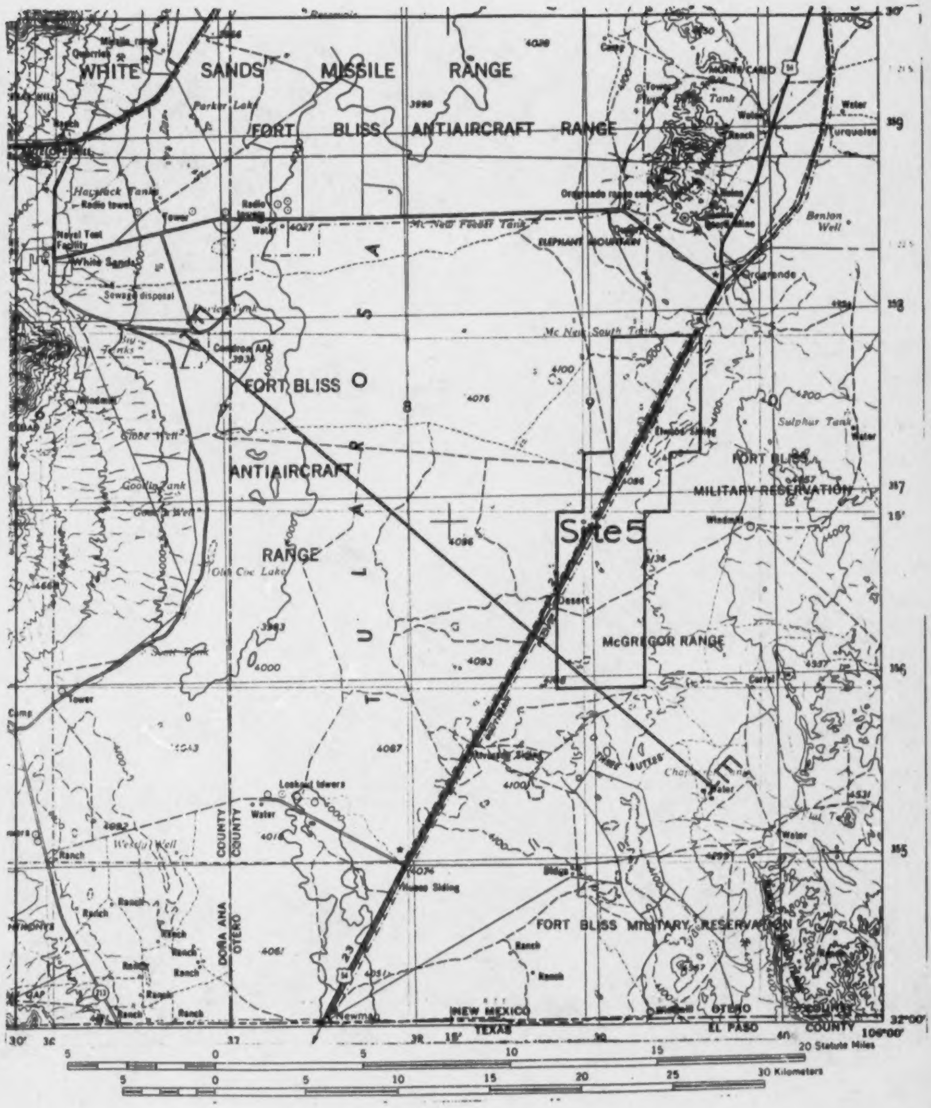

WHITE SANDS MISSILE RANGE
FORT BLISS ANTIAIRCRAFT RANGE
FORT BLISS ANTIAIRCRAFT RANGE
TULAROSA
Site 5
Desert
McGREGOR RANGE
FORT BLISS MILITARY RESERVATION
FORT BLISS MILITARY RESERVATION
ELEPHANT MOUNTAIN
Orogrande
D
E
NEW MEXICO
TEXAS
DONA ANA COUNTY
OTERO COUNTY
OTERO
EL PASO
COUNTY
32°00'
106°00'
20 Statute Miles
30 Kilometers

Figure 6. Index map to Site 5 area (Desert) and location of section EE'

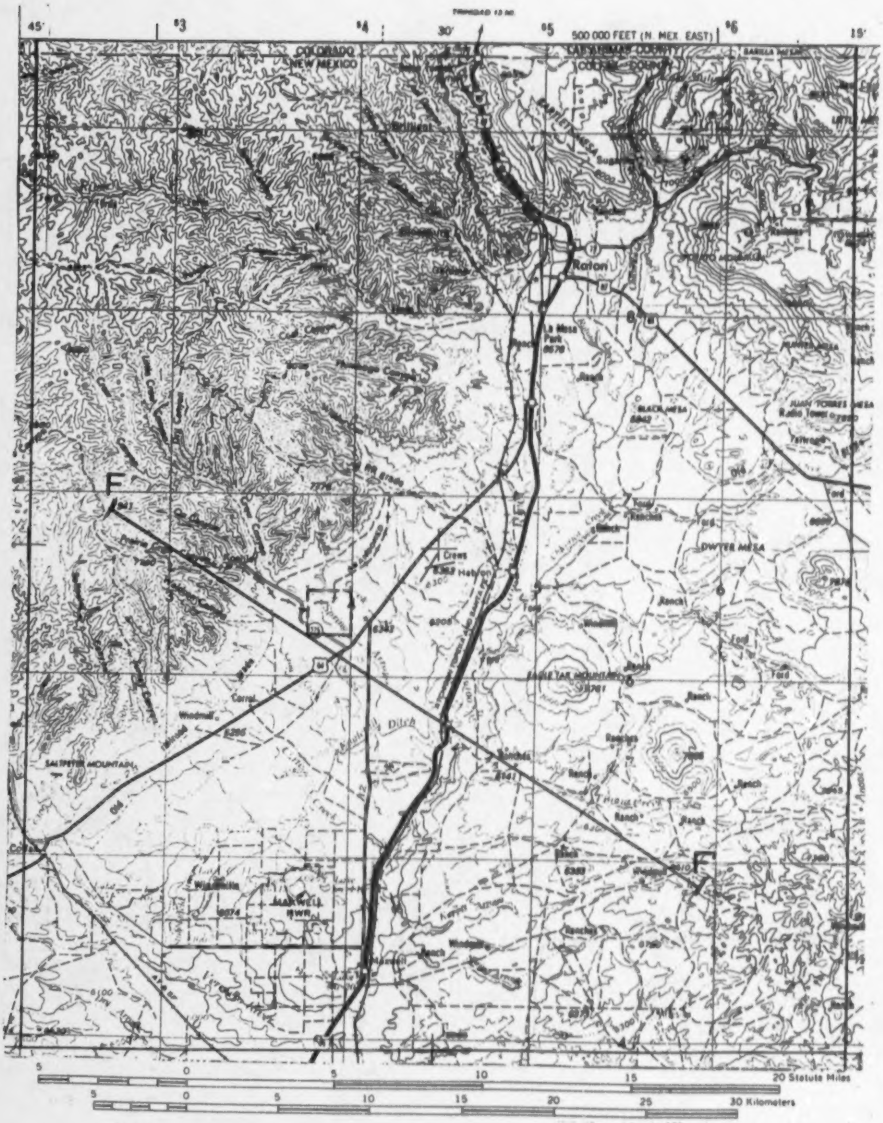
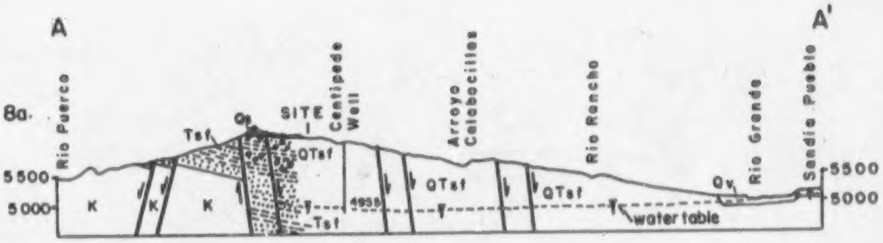
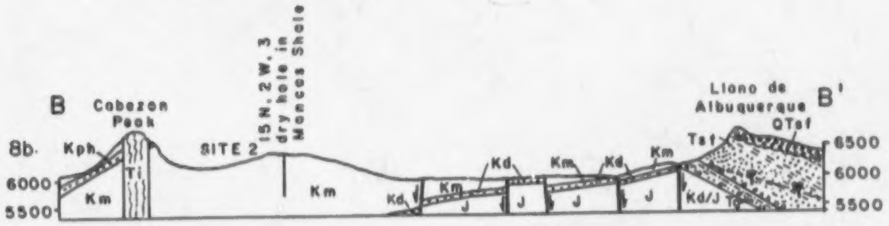

45'
3
4
30'
5
500 000 FEET (N. MEX. EAST)
6
15'
COLORADO
NEW MEXICO
Raton
BLACK MESA
DWYER MESA
EAGLE TAIL MOUNTAIN
SALTPETER MOUNTAIN
MAXWELL NWR
Ditch
F
F'
5
0
5
10
15
20 Statute Miles
5
0
5
10
15
20
25
30 Kilometers

Figure 7. Index map to Site 6 area (Raton-Koehler) area and location of section FF'


A
A'
8a.
Rio Puerco
Qs
SITE 1
Centipede Well
Arroyo Calabacillas
Rio Rancho
Rio Grande
Sandia Pueblo
Tsf
QTsf
K
4938
Qv
water table
5500
5000

Qs	Windblown sand
Qv	Rio Grande Valley Fill-sand, gravel, silt, clay
QTsf	Upper Santa Fe Group-sand and gravel; interbedded with some clay and silt
Tsf	Lower Santa Fe Group-interbedded sand, silt, and clay
K	Undivided Mesozoic rocks-mostly Cretaceous shale and sandstone


B
B'
8b.
Cabezon Peak
SITE 2
15 N. 2 W. 3 dry hole in Mancos Shale
Llano de Albuquerque
QTsf
Tsf
Kph
Ti
Km
Kd
J
Kd/J
6500
6000
5500

QTsf	Upper Santa Fe Group-sand and gravel
Tsf	Lower Santa Fe Group-sand, silt, clay
Tg	Galisteo Formation-sandstone and mudstone
Tsj	San Jose Formation-sandstone
Tn	Nacimiento Formation-shale with minor sandstone
KToa	Ojo Alamo Sandstone
Kk	Kirtland Shale
Kph	Point Lookout Sandstone-Hosta Tongue
Km	Mancos Shale
Kd	Dakota Sandstone
J	Jurassic mudstones and sandstones

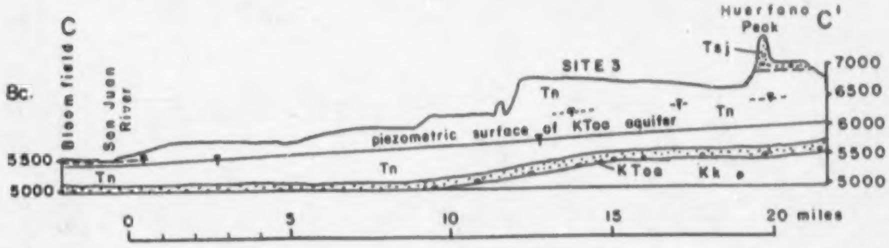

C
C'
8c.
Bloomfield
San Juan River
Huerfano Peak
Tsj
SITE 3
Tn
piezometric surface of KToa aquifer
KToa
Kk
7000
6500
6000
5500
5000
0
5
10
15
20 miles

Figure 8 a-c. Hydrogeologic sections AA', BB', CC' of Site 1, 2, and 3 areas

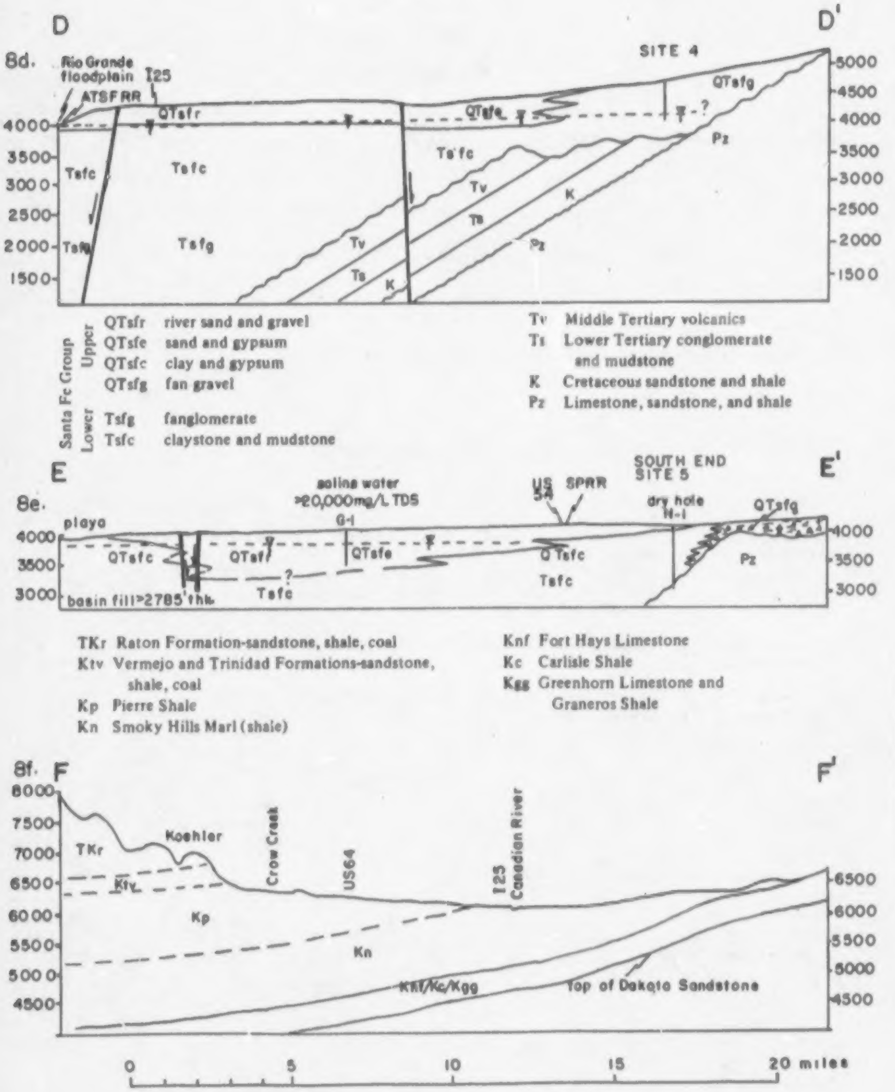

D
D'
8d.
Rio Grande floodplain
I25
ATSF RR
SITE 4
QTsfr
QTsfe
QTsfg
Tsfc
Tsfg
Ts'fc
Tv
Ts
K
Pz
4000
3500
3000
2500
2000
1500
5000
4500
Upper
Lower
Santa Fe Group
QTsfr river sand and gravel
QTsfe sand and gypsum
QTsfc clay and gypsum
QTsfg fan gravel
Tsfg fanglomerate
Tsfc claystone and mudstone
Tv Middle Tertiary volcanics
Ts Lower Tertiary conglomerate and mudstone
K Cretaceous sandstone and shale
Pz Limestone, sandstone, and shale
E
E'
8e.
playa
saline water >20,000mg/L TDS
G-1
US 54
SPRR
SOUTH END SITE 5
dry hole H-1
QTsfc
QTsfr
QTsfe
Q Tsfc
Tsfc
QTsfg
Pz
basin fill>2785'thk.
4000
3500
3000
TKr Raton Formation-sandstone, shale, coal
Ktv Vermejo and Trinidad Formations-sandstone, shale, coal
Kp Pierre Shale
Kn Smoky Hills Marl (shale)
Knf Fort Hays Limestone
Kc Carlisle Shale
Kgg Greenhorn Limestone and Graneros Shale
8f.
F
F'
Koehler
Crow Creek
US64
I25
Canadian River
TKr
Ktv
Kp
Kn
Knf/Kc/Kgg
Top of Dakota Sandstone
8000
7500
7000
6500
6000
5500
5000
4500
0
5
10
15
20 miles

Figure 8 d-e. Hydrogeologic sections DD', EE', FF' of Site 4, 5, and Koehler areas

1979-80 statistics

NEW MEXICO

LLW Generation

Facility	1979 Ft^3/Yr	1979 Mci/Yr	1979 Percentage (Volume)	1980 Ft^3/Yr	1980 Mci/Yr	1980 Percentage (Volume)
Medical	190	9	6.8	105	4.6	0
University	2,302.5	467.3	82.5	1,252.5*	12,794*	100
Industrial	300	83	10.7	0*	0*	0
TOTAL	2,792.5	559.3	100	1,357.5	12,788.6	100

---

* Does not include waste currently stored for future disposal.

Waste Forms, Radioisotopes

Licensee	Radioisotopes	Form	1980 Ft^3/Yr
University of New Mexico	Xe-133, Ga-67, Se-75, In-111, Ni-63 I-131, I-125, H-3, C-14, Tl-201 I-123, S-35, Cr-51, Co-57, P-32, Ca-45, K-42, Tc-99, Fe-59, Co-60, Eu-152, Ra-226, Mo-99, Se-75, Rb-86	Solid or adsorbed liquid.	1,252.5
Interstate Industrial Laundry	Pu-238, Pu-239, Mixed fission products	Solid	0*
Eberline Instrument Corp.	Am-241, Sr-90, Co-60, Pu-238, Pu-239, Cr-137, Ba-133	Solids or adsorbed liquids in very small quantities	0
Presbyterian Hospital	I-125, Co-57, Cr-51, H-3	Solids or adsorbed liquids	105
TERA (Terminal Effects Research & Analysis Group, NMIMT)	Depleted Uranium	Solid	0*

---

* Does not include waste currently stored for future disposal.

1981-82 statistics

1-2

NEW MEXICO

LLW Generation

Facility	19 81 Ft^3/Yr	Mci/Yr	Percentage (Volume)	19 82 Ft^3/Yr	Mci/Yr	Perce (Vol
Medical	0	0	0	0	0	0
University	1414.5	554.73	70	1313.9	460.17	70
Industrial	599.0	129.0	30	572.5	70.87	30
TOTAL	2013.5	683.73	100	1885.4	530.97	100

---

* Does not include waste currently stored for future disposal.

Waste Forms, Radioisotopes

Licensee	Radioisotopes	Form	1982 Ft^3/Yr
University of New Mexico	Xe-133, Ga-67, Se-75, In-111, Ni-63 I-131, I-125, H-3, C-14, Tl-201 I-123, S-35, Cr-51, Co-57, P-32, Ca-45, K-42, Tc-99, Fe-59, Co-60, Eu-152, Ra-226, Mo-99, Se-75, Rb-86	Solid or adsorbed liquid.	1313.9
Interstate Industrial Laundry	Pu-238, Pu-239, Mixed fission products	Solid	572.5
Eberline Instrument Corp.	Am-241, Sr-90, Co-60, Pu-238, Pu-239, Cr-137, Ba-133	Solids or adsorbed liquids in very small quantities	0*
Presbyterian Hospital	I-125, Co-57, Cr-51, H-3	Solids or adsorbed liquids	0*
TERA (Terminal Effects Research & Analysis Group, NMIMT)	Depleted Uranium	Solid	0*

---

* Does not include waste currently stored for future disposal.

TESTIMONY CONCERNING NEW MEXICO RADIATION PROTECTION REGULATIONS ON URANIUM MILL TAILINGS

BY

HAROLD A. O'BRIEN, PH.D.
CHAIRMAN
NEW MEXICO RADIATION TECHNICAL ADVISORY COUNCIL
P. O. BOX 968
SANTA FE, NEW MEXICO 87504-0968
(505) 667-4675

SENATE COMMITTEE ON ENVIRONMENTAL AND PUBLIC WORKS
JULY 6, 1983
1:00 P.M.
ALBUQUERQUE PUBLIC LIBRARY AUDITORIUM
501 COPPER, N.W.
ALBUQUERQUE, NEW MEXICO

Mr. Chairman, My name is Harold A. O'Brien. I have a Ph.D. in Chemistry from the University of Tennesee and am a Group Leader at the Los Alamos National Laboratory. I am also Chairman of the New Mexico Radiation Technical Advisory Council and served as Chairman throughout the hearings during which the New Mexico Radiation Protection Regulations for the control of uranium mill tailings were developed. The Council provides technical expertise and advice to the Environmental Improvement Board in matters dealing with radiation and must consent to all radiation regulations approved by the Board. The present membership of the Council is provided in an attachment to this statment.

New Mexico owes you, Mr. Chairman, a great debt of gratitude for your amendment to the Uranium Mill Tailings Radiation Control Act. This amendment requires the Environmental Protection Agency to set standards by specific dates for both inactive and active mills, a review by the Nuclear Regulatory Commission of their regulations to conform with the Environmental Protection Agency standards, and provides for a public hearing for any state that the Nuclear Regulatory Commission concludes has uranium mill tailings regulations which do not adequately protect public health and safety. All of these processes are well conceived and adequately protect New Mexico's interests properly.

New Mexico's uranium mill tailings regulations were developed in a lengthly public hearing process, in which the Nuclear Regulatory Commission provided extensive technical testimony in support of it's former regulations. Those Nuclear Regulatory Commission regulations are now recognized by the Nuclear Regulatory Commission as being inappropriate and are proposed to be suspended. In addition, the general public, environmental groups, and industry testified and were cross examined under oath. Testimony since 1979 on these issues comprises a hearing record that stands over two feet high and exceeds 4700 pages. New Mexico's Environmental Improvement Board adopted, with the Radiation Technical Advisory Council's advice and consent, regulations based upon the testimony and on the practicability of these regulations in New Mexico to protect public health and safety as provided for by law. With the exception of a law suit in 1980 over two minor issues, no law suits were filed contesting these New Mexico Regulations.

New Mexico has much to be proud of with respect to its regulations. By requiring performance standards instead of placing reliance on design standards, New Mexico regulations are certainly the most stringent in this country. This is a key point. New Mexico will insist on a licensee's meeting these performance standards for reclamation of a tailings pile before the State will accept custody of the pile. Mere reclamation to a design standard, whether it works or not, is not acceptable. The concept of approving a design without insisting on performance is irrational. Although New Mexico has not yet accepted a single stabilized tailings pile, our Continued Care Fund, now standing at 5.8 million dollars, offers excellent assurance that costs for inspection and necessary maintenance of any future state-accepted pile, if needed, would be covered well past its 200 year design standard. It should be mentioned that it was only through a series of insistent criticisms by New Mexico that the Nuclear Regulatory Commission raised their long-term inspection charge to $250,000 collected at the end of operations, where as New Mexico collects $1,000,000 at the beginning of operations. It is interesting to note that the newer federal proposals such as the Environmental Protection Agency's 40 CFR 192 have replaced the Nuclear Regulatory Commission's former "fix it and forget it" philosophy in favor of institutional controls, scheduled inspections, and necessary maintenance. This is the position adopted by New Mexico in its regulations.

The Nuclear Regulatory Commission originally prohibited self-insurance. Later that agency's staff study for nuclear power plants, involving much larger sums of money, concluded that the utilities themselves were better assurance than bonding companies. New Mexico reached a similar conclusion in 1981 and permitted limited self-insurance with specific controls as do Texas and Colorado.

To facilitate comparision I have prepared a table showing comparable Nuclear Regulatory Commission regulations, proposed Environmental Protection Agency standards and New Mexico regulations. Some of these items merit discussion.

Sheer pragmatism caused New Mexico to forgo acceptance of the Nuclear Regulatory Commission's arbitrary three meters of soil cover over tailings piles. This rejection was based upon the vulnerability of soil alone against errosion and the areas that would have had to be denuded to obtain this cover, thus creating dust bowls in our fragile environment. For example, to cover the Kerr-McGee pile would involve scraping off a foot of top soil over 12 square miles. This is more top soil than exists in much of the Ambrosia Lake area.

Similarly, the two picocurie per square meter per second emanation rate was rejected since it is not a health standard, is exceeded commonly in nature, does not meet a reasonable cost-benefit analysis and was determined to be useless as a performance standard. This is because measurements of emanation rates cannot be made with any degree of reproducability due to the fact that radon emission is a function of soil-moisture content, density of compaction, atmospheric pressure, and micrometerology. Additionally, containment and collection of radon over reasonably long periods of time is difficult. Radon concentrations in air can be measured reliably. For many years the Maximum Permissible Concentration in air above natural background of 3 picocuries per liter for radon-222, or 0.03 working levels for radon progeny, has been an acknowledged health standard for an individual in an unrestricted area. Such values have stood the test of time and appear to be adequate to protect the health and safety of the people of this State.

The Environmental Protection Agency has changed its radon emanation rate to 20 picocuries per square meter per second. This value correlates well with New Mexico's MPC for radon in air, provided that an appropriate access-limited area is established around a tailings pile, that moisture and density in the cover doesn't vary appreciably, and that the wind rose is reasonably predictable. All of these caveats are additional justification why New Mexico chose to remain with the proven, measurable values of radon concentrations in air.

Regarding ground water, New Mexico's Water Quality Control Commission regulations have stood the test of time and the challenge of law suits. From the adoption of the State ground water regulations in 1977 through March 1983, 279 discharge plans have been submitted, 203 approved, 3 disapproved and the remainder either withdrawn or currently under review. There are no known ground water pollution problems due to new discharges initiated since implementation of the 1977 state ground water regulation. We believe our ground water requirements are appropriate and effective for protecting ground water in New Mexico.

Radium in soil, the last item on the chart, deserves a question or two to be posed to the Environmental Protection Agency. If no one is going to live on or near a tailings pile, why should the cleanup of radium in soil be to such levels as would permit home construction and occupancy? Does the Environmental Protection Agency consider such a value to be appropriate in an area such as Ambrosia Lake where large natural uranium outcroppings exist and where mining activities have contaminated large areas far above this value?

I am not saying that that New Mexico's regulation are perfect. We may need some minor adjustments to our regulations based on experience and as a result of the Nuclear Regulatory Commission final regulations.

In conclusion I wish to thank you, Mr. Chairman, for your efforts on behalf of the best interests of our State. To you, Mr. Ruckelshaus, I invite your attention to the many technically sound and practical features of New Mexico's regulations and the extensive hearing process through which they were adopted. After all, New Mexico has about half of the U.S. uranium mining and milling industry and must live in close proximity with it. Our regulations must not only be appropriate for the present while the industry operates but must also be appropriate for a very long time in the future after the industry ceases to operate. We have strived diligently to arrive at practical regulations which the industry can live with and still meet the prime consideration to protect the health and safety of all the people of New Mexico and its environment. We believe we have.

URANIUM MILL TAILINGS
STABILIZATION STANDARDS AND REGULATIONS

June 23, 1983

Standard/Regulation	NRC*	EPA Active #	EPA Inactive	New Mexico
Longevity (Years)	1,000's	200 - 1,000	200 - 1,000	200
Radon Emanation Rate (pCi/M^2-Sec)	2	20	20	NS
Ground Water Requirements	No Degradation	EPA Drinking Water Standards	NS	State Quality Standards
Radon in Bldgs. (WL)	NS	NS	0.02	0.03
Radon Concentration (pCi/l)				
On Tailings Area	30	NS	NS	30
At Area Boundary	3	NS	0.5	3
Cover Thickness (Meters)	3	NS	NS	NS
Radium in Soil pCi/gm	NS	5	5	NS

---

* NRC Proposed on May 26, 1983 to suspend all technical criteria on or before July 28, 1983, to consider amending NRC rules to conform to EPA rules.

"NS" Means Not Specified

Proposed standards, April 29, 1983

RADIATION TECHNICAL ADVISORY COUNCIL

NAME	SPECIALTY
O'Brien, Harold A., Ph. D., Chairman Group Leader Los Alamos National Laboratory	Radiochemistry
Cleveland, James Earl,B. Sc. Kerr McGee Corp. Grants, New Mexico	Environmental Engineering
Jordan, W. Marion, M.D. Radiology Associates of ABQ Anna Kaseman Hospital	Nuclear Medicine Radiology
Strom, Peter O., Ph.D. Sandia National Laboratory	Nuclear Chemistry Nuclear Safety
Thompson, Charles M., M.D. 1601 Park Avenue, SW Albuquerque, NM 87104	Nuclear Medicine Radiology (Retired)
Weigand, Gilbert G., Ph.D., P.E. Sandia National Laboratory	Nuclear Safety Studies
Wilkening, Marvin H., Ph.D. Dean of Graduate Studies NM Institue of Mining and Technology	Radon/Decay progeny

JUL 15 1983

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W. E. BONDURANT, JR. (1913-1973)
ROBERT A. STONE (1905-1981)

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July 12, 1983

Hon. Pete Domenici
U.S. Senator
Room 140, Federal Bldg.
Roswell, New Mexico 88201

Re: U.S. Senate Environment and Public Works Subcommittee Public Hearing

Dear Senator Domenici:

Thank you and Mr. Ruckelshaus for the opportunity to attend a Subcommittee meeting on Environmental Affairs in New Mexico. Your continued interest in the affairs of New Mexico are indeed appreciated.

You will recall that the representative of the New Mexico Citizens for Clean Air and Water Association suggested to the Subcommittee the possibility of expanding the response to the acid precipitation problem to all forty-eight states. This would mean a further reduction of SO_2 emissions across the country at considerable expense per location.

Ignoring for the moment the economics of the situation, the fallacy of going to a forty-eight state participation on the basis of the acid precipitation problem is evidenced in the 1982 Annual Report to the President and Congress by the National Acid Precipitation Assessment Program. While I am confident you have had an opportunity to review this document, I enclose herewith a photocopy of this most recent report. Incorporated into the report are a map and text dealing with the total alkalinity of the surface waters throughout the forty-eight states. Contained within the introduction of the text, prepared by the U.S. Environmental Protection Agency, is the explanation that "Total alkalinity is used as an index of sensitivity because it expresses the acid neutralizing capacity of water bodies and thus their relative sensitivity or tolerance to acide input." A review of the accompanying map will quickly demonstrate that outside of the Deep South, Eastern Seaboard, and Northwest Pacific, generally the country is on the higher end of total alkalinity, and therefore more resistent to acid precipitation.

It can readily be seen that the notion of expanding the more restrictive SO_2 standards in response to acid precipitation is not supported by even the most recent National Acid Precipitation Assessment Program Report to Congress. We ask the Subcommittee to consider this important document in its deliberations.

Thank you very kindly for the opportunity to afford some input.

Very truly yours,

HINKLE, COX, EATON, COFFIELD & HENSLEY

Paul M. Bohannon

PMB:mh
Enc.
cc: Darrell Bearden

Senate Committee on the Environment and Public Works

Field Hearing
Albuquerque, N.M.
July 6, 1983

Written Testimony Submitted by:

Carol Cochran
1415 Phoenix N.W.
Albuquerque, N.M. 87107

I am submitting this testimony because I am concerned about an EPA Experimental Use Permit (EUP No. 39508-EUP-4) granted the New Mexico Department of Agriculture to use 1080 collars on sheep in New Mexico to test the safety and efficacy of a rancher certification program. The original permit was for one year; that was extended for another year, expiring February, 1983. New Mexico has applied for another extention. I urge EPA not to grant that extention. In his original application, State Agriculture Department Director William Stephens maintained that "Maximum duration for the trial program will be two years." Certainly sufficient data has been gathered to prove that the program is neither safe nor effective. Further, the program has been poorly designed and its terms violated so that grounds exist for revoking the permit were it to be renewed.

In theory, the toxic collars make some sense because only specific, offending predators are killed and non-offending coyotes and non-target wildlife are saved. Unfortunately practice does not correspond to theory. During the two years of the EUP, 15 ranchers used 330 collars for a total of 17,900 collar nights. In that time, 13 collared sheep were attacked and killed, but only 7 of those attacks resulted in punctured collars. In the rest, the predators either did not attack the neck or missed the collar when they did. Thus coyote attack behavior corresponded to theory only 54% of the time. Actually, the evidence pointing to coyotes as the attackers is circumstantial, because only two coyote carcasses were ever found. 1080 kills slowly, however, and its victims wander and are not always easy to find. Nevertheless, in 2 years, the most one can say with certainty is that collars have killed two coyotes.

In addition to the two coyote carcasses, one bobcat carcass was found after a sheep had been killed and its collar punctured. Although a predator, the bobcat was not a target species for the collar. Another non-target animal, a skunk, was killed when it fed on the improperly buried carcass of a collared sheep. Thus, of the 4 animals which the supposedly selective 1080 collar is known to have killed, half were non-target victims.

As an experiment, this program was poorly designed and therefore yielded no reliable information on the collar's ability to reduce predation. There were no control flocks or objective before-and-after predation rate studies. Many non-collared sheep, separated from collared sheep and withdrawn to safer pastures, were attacked during the program, but careful accounts of their numbers were not kept. And, while the collars were in use, other methods of predator control, such as aerial gunning and trapping, were being conducted on the same ranches. But what data does exist points to the ineffectiveness of the collar. Testifying at the EPA hearings on 1080 in April, 1982, EUP Project Director Gary Littauer of the New Mexico Department of Agriculture agreed that the collar "hasn't been very effective at all in reducing predation losses."

In addition to being ineffective, the collars have also proven unsafe. Once filled with 1080, the collars were turned over to cooperating ranchers, who had received one-half day's training in their use. Several ranchers violated use restrictions placed by EPA on the collars. One failed to keep records and failed to store the 1080 under lock and key, as required. Another failed to properly and promptly dispose of the collared sheep carcass which resulted in the skunk's death. One rancher reported the theft of several collared sheep. And, most disturbing, an employee of one rancher removed the 1080 from the collars with a syringe, stored it in unmarked containers, and presumably meant to sell it or use it in large baits.

Contrary to use restrictions, collars were used in an area which had not been experiencing predation problems and were left on sheep longer than the 60 day maximum. Several lambs may have strangled to death on collars which were not adjusted as the lambs grew. And 21 collared lambs were missing and never found and thus no one knows the fate of the poison in their collars.

Numerous accidents have occurred. Eighteen collars were accidentally punctured by ranchers, livestock, cactus thorns, or fences (that's more than twice the number punctured by predators). The 1080 has spilled on the ground, the sheep, and the ranchers, an accident of considerable concern because 1080 can kill if it is inhaled or if it enters the bloodstream through an open wound. And, althouth proponents of the collar assert that spilled 1080 does not contaminate soil or water, this has not been demonstrated conclusively.

Many ranchers were unable to use the collars effectively because of the large time requirements and the restricted conditions of collar use. The collars can be used only in pastures small enough to permit daily monitoring for punctures, spills, and slipping collars. The rancher must be able to withdraw all but target sheep and place them elsewhere. And the rancher must locate all carcasses promptly and dispose of them. If a rancher is willing to go to all this trouble to eliminate a problem coyote, he might as well apply his resources to one of the many other forms of predator control (fences, guarding dogs, lamb sheds) which work better than the collar under the same small pasture conditions, but do not threaten the lives of children, pets, and domestic animals. Indeed, two of the ranchers returned their collars and employed livestock guarding dogs instead.

New Mexico's EUP program was perhaps useful in demonstrating the ineffectiveness of the toxic collar and in showing that, even under careful conditions, regulations will be abused and accidents will occur. But there is no longer a purpose for the EUP. To continue use of this dangerous poison on New Mexico rangelands would be to invite trouble.

ENVIRONMENTAL DEFENSE FUND

July 25, 1983

Honorable Pete Domenici
4239 Dirksen Senate Office Building
Washington, D.C. 20510

Re: Senate Environment Committee Record

Dear Senator Domenici:

Reports from observers of the Senate Environment Committee hearing you conducted in Albuquerque earlier this month indicate that industry is continuing to raise objections to achieving effective levels of radon control from uranium mill tailings piles based on the need to obtain vast amounts of cover material which, they argue, is generally not available. I am surprised that industry has not been forthcoming enough with you on this issue to have shared their experience with the most recent development in tailings disposal technology -- deep trench disposal.

Three new mills have recently been licensed by the States (Gulf and Bokum in New Mexico and Homestake in Colorado) to use deep trench disposal. This technique has numerous advantages, not the least of which is the availability of sufficient cover to nearly eliminate all radon releases from the tailings. Because the trenches are excavated to about fifty feet, a large volume of soil and rock material is automatically available on-site for use as cover when the trenches are filled. Thus the need for off-site soil or rock is virtually eliminated unless design requirements call for the addition of a thin impermeable clay layer somewhere in the cover. Even if off-site clays are required, the total surface to be covered is substantially reduced because the tailings are not spread out over a large area.

This technique also has numerous other advantages, including:

1) trench disposal allows for rapid placement of permanent cover (months instead of years) over segments of the tailings thereby eliminating extended exposure of tailings to the atmosphere, and also eliminating the health effects from radon exposure during the 30 year life of the mill.

2) trench disposal allows the operator to use the trench to decant and remove a large portion of the water from the tailings during placement so as to nearly eliminate any hydrologic head on the tailings and thereby remove the mechanism which causes most, if not all, of the migration of contaminants out of the tailings and into the groundwater.

3) trench disposal nearly eliminates wind dispersal of tailings during the life of the mill because the tailings will be moist during the short period of exposure to the atmosphere, and will be covered as soon as they are dry.

For these reasons and others included in our comments to EPA, EDF believes that this technique offers an opportunity to strike a balance, i.e., an affordable solution to one of industry's most serious objections to the requirement to achieve effective control of radon while at the same time maximizing the public health and environmental goals of the Uranium Mill Tailings Act. Accordingly, we have urged EPA to revise the active site mill tailings regulations to reflect this new technological approach to a difficult problem. A copy of our comments are enclosed for your information.

We are, of course, disappointed that the industry witnesses at the hearing did not explain this advance in disposal technology, and its obvious cost and environmental advantages. Since they did not, EDF respectfully requests that this letter and our enclosed comments on the proposed mill tailings regulations be included in the record of the hearing.

EDF intends to follow both EPA's development of the mill tailings rule and NRC's implementation. We also have been actively involved in SO_2 pollution issues that are important to New Mexico including smelters, power plant emissions and synfuels development. EDF has also played an active role in the unfolding issues related to the proposed Chaco-Bisti coal lease sale. We have more members per capita in New Mexico than any other western state. Although our Rocky Mountain regional office is in Colorado, we intend to continue to focus on environmental issues of concern to our New Mexico members.

We hope, therefore, that you will offer EDF an opportunity to participate in any future committee hearings that address issues in which we have developed expertise. In this case, for example, we think your hearing record would have been much more comprehensive had we had an opportunity to present the results of our investigation into available mill tailings disposal techniques.

Absent our direct participation in the hearing, however, we appreciate this opportunity to include our evaluation of the problem in the record and share these thoughts with you.

If we can provide any additional information or otherwise be of assistance, please let us know.

Sincerely,

Bob Yuhnke

Robert E. Yuhnke
Regional Counsel

REY:mh
Enclosure
cc: W. Ruckleshaus

COMMENTS BY THE
ENVIRONMENTAL DEFENSE FUND
ON PROPOSED ENVIRONMENTAL STANDARDS
FOR ACTIVE URANIUM MILLS

Docket No. A-82-26, 48 Fed.Reg. 19584
(April 29, 1983)

Prepared by

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[Note: The following has been excerpted from the above named report. The report has been retained in committee files.]

June 29, 1983

ENVIRONMENTAL DEFENSE FUND

INTRODUCTION

Following are comments by the Environmental Defense Fund (EDF) on behalf of itself and its members on the proposed standards governing the disposal of uranium and thorium mill tailings. EDF is a charitable, non-profit, public membership organization composed of scientists, lawyers, economists, educators and other concerned citizens dedicated to the protection and enhancement of human health and the environment through research and education and through judicial, legislative and administrative action. Organized under the laws of the State of New York, EDF maintains regional offices in Boulder, Colorado; Washington, D.C.; New York City; Richmond, Virginia; and Berkeley, California. EDF has 47,000 active members nationwide, over 1200 of whom reside in Colorado, Utah, Wyoming and New Mexico.

SECTION I

SUMMARY

Generally, our review of the total set of environmental issues associated with uranium mill tailings leads to two conclusions:

1). tailings should be disposed of below grade in deep trenches following, or as part of, dewatering.

2). tailings disposal sites should be carefully sited so as to isolate the tailings from close proximity to a) groundwater, and b) surface waters which may erode the cap from above or the trenches from the side, as a result of flooding, stream meander and downcutting.

The proposed standards do not specifically require the use of below-grade disposal, dewatering prior to, or as part of, placement into the site of final repose, or isolation criteria. But because of the compelling logic which supports each of these concepts, we request that the regulations be revised to specifically require these two disposal techniques, or be written in such a way as to require the performance benefits available by use of these techniques. The isolation criteria should be specifically identified as siting criteria for the disposal of new tailings after the effective data of the rules.

The reasons for these conclusions are set out in greater detail below, and are summarized here.

Below Grade Disposal.

Disposal in trenches below grade offers advantages with respect to every hazard against which the standards are required to protect. First, disposal in trenches reduces the surface area of the tailings and increases their depth thus automatically achieving some reduction of radon flux by reducing the overall proximity of radium to the cover, thereby increasing the migration time for radon and reducing the total amount of radon to reach the cover since migration time will exceed decay time for much more of the pile than if the pile were disposed of in shallower, surface impoundments.

Second, disposal in deep trenches increases the long-term stability of the tailings by nearly eliminating any risk of dispersal by wind or flood erosion.

Third, disposal in deep trenches can be completed in such such a way as to use the trench, if the bottom is sloped, to decant and remove a large portion of the water from the tailings during placement so as to nearly eliminate any hydrologic head on the tailings and thereby remove the mechanism which causes most, if not all, of the migration of contaminants out of the tailings and into surrounding soils and groundwater.

Fourth, disposal in trenches allows for the rapid placement of permanent cover (i.e., months instead of years) over segments of the tailings from a given mill thereby eliminating extended exposure of tailings to the atmosphere, and also eliminating to the same degree the risk of health effects from radon exposure during the life of the mill.

Fifth, trench disposal nearly eliminates windblown tailings during the life of the mill because the tailings will be moist during the short period of exposure to the atmosphere, and will be covered as soon as they are dry.

Sixth, trench disposal avoids any need to search for or purchase cover materials since the cover is supplied by the material removed during excavation of the trench. In addition, the total surface area to be covered is reduced approximately by the same ratio as the increased depth of the tailings in a the trench compared to the depth of surface pile. As a result of decreased surface area and the ready availability of cover, the thickness of cover needed to achieve radon emanation rates approximating background is readily accomplished.

Seventh, below grade disposal offers the opportunity to separate the topsoil layer during excavation and replace it after closure thus facilitating revegetation.

Eighth, below grade disposal with the restoration of native vegetation restores the site to its approximate contour and appearance so as to effectively camouflage the location and reduce the likelihood of future human intrusion.

Ninth, disposal in trenches facilitates monitoring of both groundwater and the vadose zone below the trenches because monitoring wells can be located between trenches (at intervals of two or three) and will not interfere with the integrity of liners or bedding formations.

Dewatering Before Disposal.

The evidence of groundwater contamination associated with the inactive mill tailings sites in the semi-arid West (where evapo-transpiration exceeds precipitation) shows that contamination occurred under two circumstances: 1) a plume from the pile driven largely by the hydrologic head on the pile during its active life, and 2) seasonal contact between the pile and shallow aquifers. Although the data are skimpy at best, the evidence also suggests that migration of contaminants from the piles stopped after the piles dried out and the driving force (hydrologic head) was removed. If correct, the obvious implication of these data is that dewatering of the tailings prior to or during placement would nearly eliminate the movement of significant plumes of contaminants into nearby soils and groundwater.

Given 1) the high cost and technical uncertainties associated with decontaminating aquifers once they have become polluted, 2) the limited water resources available in the West, 3) the need to protect the quality and hence usefulness of all usable water supplies to meet both current and future needs, 4) the high mobility and rapid migration to groundwater of certain contaminants in mill tailings such as nitrates and sulfates, and 5) the lack of any evidence to show that natural or synthetic liners will remain 100% effective when exposed to the highly reactive and physically unstable tailings for the life of a tailings pile, EDF believes that the only reliable and effective strategy for containment of tailings is to dewater the tailings prior to or during placement.

Variations of this approach have been proposed for use by at least three mills, and have been approved by licensing agencies in New Mexico and Colorado. These proposals by industry create a strong inference that these techniques are both economically and technologically feasible for new mills.

The difficult economic issues arise in the context of existing tailings at active mills. For mills which are approaching the end of their useful economic life, i.e., where enforceable obligations to close and stabilize the site within two years are obtained as license conditions, then little incremental risk will be incurred if the site is operated under general regulatory requirements governing radon emanation and groundwater protection, with final disposal in-place. But the level of protection for groundwater which applies under the SWDA, 40 C.F.R. 264.90 et. seq., and the level of control for radon required under section 112 of the Clean Air Act (CAA), i.e. to background, must be met.

If these general standards can be met even though existing piles are left in place, then the below grade disposal, dewatering and siting criteria could be waived. But if groundwater contamination has occurred or occurs prior to the drying of the pile, or soil monitoring in the vadose zone or other conditions at the site indicate that compliance with the general performance standards will not be maintained by disposal in-place, then the pile should be moved and disposed of in accordance with the disposal techniques and siting criteria outlined above for new tailings.

We recognize that by accepting in-place disposal of existing piles that we risk higher probabilities of groundwater contamination and shorter periods of assured long-term stability. But we also believe that if economics are to be weighed in the setting of these standards, cost should be considered only in the context of decisions in which there are relatively large uncertainties, and which do not compromise protection for critical values, such as human health and groundwater uses. Thus we do not think UMTRCA and the SWDA allow EPA to set general standards which would recognize and accept the degradation of groundwater below levels needed to preserve current or potential uses, nor do we think the CAA allows EPA to set the radon standard at a level which will knowingly cause excess deaths above background. But we do accept as valid the consideration of economics when addressing the ways in which existing piles may be treated compared to the criteria for disposal of new tailings at new mills or at existing mills after some reasonable transition period such as two years. While it is both environmentally sensible and reasonably cost-effective to require below grade disposal and dewatering for new tailings, it is much more difficult to justify imposing those requirements on tailings in-place without an initial finding based on site specific conditions that the additional risks associated with permanent disposal in-place are too high to accept. This decision should be made in the context of licensing or license renewal for existing sites subject to the environmental review and public participation requirements of section 274 of the AEA.

Thus, EDF recommends the adoption of general standards governing radon release, groundwater protection and long-term stability (as discussed below in greater detail) applicable to all sites. In addition, siting criteria and the two disposal techniques (or their equivalent) should be mandated for new tailings, and also required for existing tailings but subject to a waiver procedure for those piles that do not meet these criteria based on a demonstration by the operator to the licensing authority that the air, water and longevity standards can be achieved and maintained by closure of the existing pile. All new tailings generated after a transition period (we suggest two years to allow for license procedures) must comply with all requirements.

STATEMENT REGARDING MURRAY ACRES/BROADVIEW ACRES PROBLEMS WITH HOMESTAKE MINING COMPANY'S TAILINGS PILE

July 1, 1983

On July 1, 1975 the New Mexico Environmental Improvement Agency met with residents of Murray Acres and Broadview Acres, communities situated near the tailings pile of the uranium mill operated by United Nuclear-Homestake Partners. At this meeting the residents were informed that water samples taken from domestic wells in the area indicated contamination by selenium at levels which were considered hazardous to the health of anyone consuming this water.

United Nuclear-Homestake Partners, upon release of this information, denied any responsibility for contamination of the alluvial aquifer. However they did offer to deliver "bottled" water to residents for human consumption. Those who accepted this offer found that the "bottled" water consisted of plastic jugs filled by a UN-HP employee from an uncontaminated well in a very unsanitary manner as could often be evidenced by foreign particles found in the so-called "bottled" water.

A series of meetings between UN-HP and residents followed with the mill mainly concerned with denying any responsibility for the problem. However, on August 18, 1976, UN-HP entered into an agreement with the State of New Mexico Environmental Improvement Division for the injection of water into the alluvium from which the Broadview and Murray Acres subdivisions' domestic wells produced water. This program was instituted for Broadview but not operated full time for the next several years.

No progress was made along these lines for the next two years at which time UN-HP made arrangements to use certain wells within the Murray Acres subdivision for withdrawal of water as part of an injection and recovery program. Progress along this line has been minimal to date.

During the years, 1976 to date, a number of residents/mill meetings have been held with the mill advising what should happen with the injection/recovery program with minimum evidence that any progress was being made.

Property owners in the affected areas had a ready market for disposal of their holdings prior to July 1, 1975. After the announcement regarding the contaminated water, the area became unmarketable. Lending institutions would not make loans in the area. Potential buyers disappeared. It became an area of no sales value. In the course of living people do have to move which, in the case of these subdivisions, meant a financial sacrifice as it was almost impossible to dispose of this property at any price.

United Nuclear-Homestake Partners was dissolved in the spring of 1981 with Homestake Mining Company being the continuing operator.

Sampling and technical analysis strongly indicate that the source of contamination by selenium as well as other elements, is the tailings pile through which leaches water used in the milling process. Since the Broadview and Murray Acres subdivisions lie down grade, in so far as the alluvial aquifer is concerned, from the tailings pile the contaminants are carried down stream to the subdivisions.

Contaminants leached from the mill waste, in addition to the health aspect, have caused excessive corrosive action on water faucets, heaters, softeners, evaporative coolers, etc. Also the quality of the water has been so altered as to make gardening and the raising of lawns and flowers an unsuccessful venture.

In view of the passage of eight years with no positive improvements made, and in view of damages suffered by property owners, many of the residents of the areas banned together to negotiate and, if necessary, litigate, for an equitable resolution of the problem.

First the properties involved were offered to Homestake at an appraisal basis equivalent to values without the presence of the contamination problem. This Homestake declined. Subsequently negotations were held whereby the residents requested the installation of a water system, connected to the village of Milan water supply, with the understanding that said system would be first class--not marginal. In addition a reasonable damage settlement was requested. Homestake representatives indicated their concurrence in this settlement. However, we subsequently were advised that they would not settle on this basis.

Having negotiated for some 10 months, we residents and property owners of the area feel we have no option other than to file a lawsuit against Homestake Mining Company to solve our problems due to their mill tailings pile.

NEW MEXICANS FOR JOBS & ENERGY

Uranium Mining and Milling:

Radiological impacts on the General Population

by Evelyn Saucier and Dave Williams

One of New Mexico's most significant natural resouces is uranium. Over half of the nation's known uranium reserves can be found in our state, and since the 1950s, mining and milling activities have had considerable impact in terms of creating jobs and providing revenue to New Mexicans.

In recent years, however, uranium industry activities have come under increased scrutiny. One hears of "mill tailings" which will remain radioactive for thousands of years. Mine vents are said to expel radioactive gases into the atmosphere. Is the general public being burdened with unacceptable risks because of the uranium industry?

We think not. The information presented in this paper helps support that point of view.

1. What are tailings?

Uranium ore contains very little actual uranium — typically from two to five pounds of uranium per ton of ore. This uranium is chemically extracted during the milling process. What is left behind after the uranium, or "yellowcake" as it is then called, is removed are the tailings.

Although milling removes most of the uranium, there are other radioactive materials that remain behind. The principal hazard associated with the tailings is caused by radon, a naturally occurring radioactive gas, and its decay products, called radon daughters, which are also radioactive. Exposure to excessively high concentrations of radon daughters is believed to have caused lung cancer among early uranium miners.

2. Are uranium mill tailings and mines the only sources of radon and its daughters?

Far from it. Radon and its daughters have always been universally present in man's environment. Radon is found in all ordinary soils, common building materials, drinking water, etc. Because it is a gas, radon readily diffuses out into the atmosphere. Concentrations of radon daughters tend to be highest in poorly-ventilated enclosed spaces (such as energy efficient homes), and in the immediate vicinity of areas with high uranium content. The highest uranium concentrations in uranium ore mean, for example, that more radon would be emitted from an acre of tailings than from an acre of ordinary soil. Nevertheless, because the tailings occupy such a minute fraction of the earth's land surface, the tailings contribute only a very small fraction of the total radon in the earth's atmosphere. For purposes of comparison:

(a) With 22 more mills than we now have, the radon from the tailings piles would amount to only two-tenths of one percent of the natural radon in the air.[1] (United States average)

(b) A square mile of ordinary land releases as much or more radon as an acre of tailings.

(c) Even if the State of New Mexico had only average soil, its total area would emit at least 100 times more radon than all of our tailings, even if the tailings were left uncovered.

3. What has been done with these tailings piles in the past? Will they remain uncovered in the future?

In the early days of uranium milling, the tailings were piled up outside the mill facility. In cases where the milling operations have ceased, the tailings were simply left behind. The term "abandoned mill tailings" is used to distinguish these tailings from the "active piles" where milling activities are still taking place. There are 42 abandoned tailings sites, most of them in western states.

Present day requirements for siting a tailings disposal area are more stringent. In addition, the Uranium Mill Tailings Radiation Control Act of 1978 requires that all tailings piles, including the abandoned piles, be covered over or stabilized in some manner to minimize any impact on the environment.

4. Who will pay for the cost of cleaning up the abandoned tailings piles?

Federal and state governments will share the cost of stabilizing inactive piles with the federal government paying 90 percent of the costs, except on Indian lands where the federal government will pay all the costs. During the 1950s and 60s, when these tailings piles were generated, the federal government was the sole purchaser of uranium which was used primarily for the weapons programs. New Mexico has two abandoned sites, one on Indian land near Shiprock, and the other in the Ambrosia Lake district north of Grants.

There are five active sites in New Mexico encompassing approximately 1200 acres, or 1.8 square miles. The companies operating the mills will bear the cleanup costs.

5. What about companies that started operations before these laws went into effect? Are they still responsible for stabilizing tailings piles?

Yes. New Mexico issues only temporary licenses to mill operators. These licenses have to be renewed every five years. In order to do so, the operator has to meet the newer, more stringent requirements.

6. What are the costs of stabilizing the piles?

Cost estimates vary depending on the size of the tailings piles and the amount of cover required to stabilize the piles. Based on approximately two feet of earth cover (which in most instances satisfies New Mexico requirements), one can estimate a $3 million to $15 million cost per site depending on the size of the tailings pile.

The Environment Protection Agency (EPA) is the federal agency responsible for setting reclamation standards, but it has not yet done so. In the absence of the EPA standards, the Nuclear Regulatory Commission (NRC) has proposed standards which are much more extreme than the state's requirements. However, these NRC proposals may have to be altered to comply with the EPA standards.

7. Are the costs of stabilizing these tailings piles warranted? What are the health risks from the tailings piles?

The key facts are these:

(a) Both theoretical modeling and actual measurements of radon levels due to tailings show that, for the vast majority of the general public, any health hazards from tailings would always be minuscule compared to other natural and man-made radiation risks. Even very close to uncovered tailings piles, health hazards are no greater than for cetain other radiation risks that are currently being ignored, e.g. home conservation measures (see Question 9).

(b) Many experts in the field of health effects of radiation, including Dr. Robley Evans,[2] a recipient of the Gold Medal of the American Medical Association, believe that covering tailings for radon control is not necessary at all, and that covering is needed only to stop them from dusting and to lessen erosion.

Some background information provides insight into the reasons for these conclusions. It is well known that exposure to large amounts of radiation can increase the risk of developing cancer many years after exposure. Health effects from low levels of radiation, such as the tailings piles, are too small to measure. Nevertheless, health protection authorities find it prudent to assume that exposure to any amount of carcinogen (including radiation) carries with it some increased risk, with the amount of risk being proportional to the exposure. Because there is additional radon released into the atmosphere from these tailings piles, the Nuclear Regulatory Commission (NRC) has calculated possible health risks to the general public. Their assumptions are quite conservative and are believed by many authorities to overstate the risks. The NRC studies[3] indicated, however, that there might eventually be an extra six cancer deaths per year in the United States population if a large number of additional mills are constructed and if all the tailings remain uncovered.

8. How does this compare to other risks?

The following data[4] are helpful in comparing risk due to uncovered tailings piles with other natural and man-made risks:

(a) It is equivalent to driving a few blocks in a car.

(b) It is equivalent to smoking less than one cigarette every ten years.

(c) The risk of cancer from saccharin due to drinking one diet soda per day is about 70 times greater than the risk due to uncovered tailings.

(d) The greater the altitude, the higher the dose of radiation due to cosmic rays. The increase in risk of cancer due to the elevation difference between Colorado and Florida is about 70 times greater than the risk from uranium mills.

(e) The increased risk of cancer due to moving from Albuquerque to Santa Fe, again due to elevation differences, is about 17 times greater than the risk from uncovered tailings.

(f) Our natural soil emits radon. The NRC estimates that there are 1200 deaths per year in the United States due to radon from the soil — compared to 6 due to tailings if they are left uncovered.

(g) The risk of radon release caused by

farmers plowing their field is ten times greater than the risk from tailings.

(h) Premature cancer deaths from radon daughters from our building interiors are estimated to be 1600 per year, again compared to 6 from uncovered tailings piles.

9. It seems hard to believe that the risk of death from tailings is so much less than that from radon daughters in buildings. How can you explain this?

In the open air, radon mixes with the atmosphere and the concentrations become very low. In most cases, if you are more than one-half mile from a tailings pile, you cannot detect any radon increase above what is the normal range for background.

This rapid dilution of radon does not occur in buildings, where the radon concentrations may tend to build up rather than be diffused. There are many sources of radon inside dwellings: construction materials such as brick, stone, concrete, and especially adobe; soils under the buildings, etc. In contrast to the tailings situation, this radon is released into an enclosed building which permits the concentration to build up in our living spaces. This problem is greatest in energy efficient buildings because effective conservation measures reduce ventilation and permit greater build-up of radon and its daughters.

Eric Geiger, a certified health physicist with Eberline Instrument Corporation in Santa Fe, New Mexico[5], measured radon levels in a sample passive solar home in Santa Fe, and found levels 50 percent higher than regulations permit even in the immediate vicinity of tailings piles! Other studies, including one performed by the University of California at Berkeley[6], have also shown that radon levels in energy efficient homes can exceed the regulatory limits imposed upon tailings piles.

A crucial difference is that a large fraction of the United States population could be exposed to the effects of residential energy conservation measures, while only a very limited number of people will ever live close to tailings. Hence, estimated health effects of these conservation measures are hundreds or thousands of times greater than the effects of the tailings even if the latter were to be left uncovered. Any requirements more stringent than those currently existing for stabilizing uranium tailings are totally unjustified in the light of potential hazards from energy conservation measures (which remain largely unnoticed and totally unregulated), as well as other natural and man-made radiation sources that greatly exceed tailings radiation exposures.

10. Is there evidence of increased rates of lung cancer among persons living in areas near tailings piles?

No! On the contrary, a study[7] has been completed documenting incidence of cancer in six counties containing abandoned mill tailings. The study covered a 20-year period and one of the counties included was San Juan County, New Mexico, which contains the abandoned tailings site near Shiprock. The radon background concentrations in all of these counties are significantly higher than average background levels in the United States. This is not due to the tailings piles, but to the naturally occurring uranium in the rocks and soil. The data indicated that rates from both respiratory cancer and the total of all types of cancer are comparable to the rates in their respective states and much below the United States rate.

In 1979, the dean of the New Mexico Medical School was quoted in the *Albuquerque Journal* as saying that "persons in the uranium belt in McKinley and Valencia Counties show no higher incidence of lung cancer than residents of the state as a whole" and that "Hispanics and Indians in the state experience less cancer than whites."

In a Sandia Laboratories document[8] concerned with hazards associated with abandoned mill tailings, it was estimated that a person living in Salt Lake City, where one of the tailings piles is located, has about the same chance of being killed by lightning as developing cancer from inhaling tailings radon.

11. Despite the low risks associated with these tailings piles, would you still advocate stabilizing them in some manner?

Stabilizing the tailings piles is a precaution which officials find advisable to control dust and reduce erosion. Two feet of cover would resist erosion along the slopes on the sides of tailings ponds for at least the two hundred years required by New Mexico state law. Engineers estimate it would take thousands of years for erosion to wear away the two feet of cover along the flat tops of the tailings ponds which account for a large part of the tailings area. In addition, two feet of cover would reduce radon emission by a factor of 2 to 10. This would lower the NRC's estimates of possible deaths from the radon to 1 to 3 deaths per year instead of 6.

12. Suppose something goes wrong? Who is going to pay for the cost of additional remedial actions?

A 1978 New Mexico law provides for just such an unlikely contingency. Companies are required to pay up to $1 million per mill into a continued care fund for surveillance of tailings ponds and any remedial action that might become necessary. With the interest on this sum reinvested in the fund, over $5 million dollars would accrue just over the 30-year life of a single mill.

13. What about uranium mines? Is there more radon coming from the mines than from the tailings piles?

Yes. Several years of monitoring the mine and mill sites by the state Environmental Improvement Division[9] (EID) indicate that radon from the mine vents contributes more radon than mill tailings in the immediate vicinity of the sites, although this does not necessarily indicate a health hazard. The following points should be noted:

(a) Uranium mines need to be vented in order to keep the radon concentration low enough to protect underground workers. Because of these vents, present day miners are exposed to radon concentrations that are roughly 100 times less than uranium miners in the 1950s.

(b) The uranium mines, unlike the mills, are not licensed by the EID and, therefore, are not subject to regulations concerning levels of emission. Nevertheless, there are recommended limits for radon emission. In some instances, such as in the Ambrosia Lake region near Grants, New Mexico, where there are high concentration of mine vents, the total emissions do result in exceeding the recommended limits by small factors over a limited area.

(c) Even in instances where recommendations are exceeded, the level of conservatism in setting standards indicates there is no imminent public health hazard. For example, exposure due to releases from the mines even in the worst cases are still five times lower than those allowed for today's underground miners. A University of New Mexico study[10] documents that no instance of lung cancer has been recorded for uranium miners who began working after 1961 when reduced standards for radon exposure to underground miners were set (although standards during the 1960s were still considerably higher than today's standards for underground miners).

(d) In most cases, no increase above background can be measured more than one-half mile away from mine vents. Hence, a logical precaution is to discourage businesses or residences from being sited close to a mine vent during the life of the operation. Most New Mexico mines are already located in low population areas. Monitoring of sites close to mine vents could be continued to keep at a minimum any unnecessary exposures to the general population.

(e) Unlike tailings, underground mines emit little radon once operations cease.

CONCLUSIONS

Though there is no proof that risks from tailings radon are zero, there is ample scientific evidence to show that the risks are small compared with many other risks that are routinely accepted and even ignored. Useful perspective is provided when we as a society consider such facts as these:

(a) Uncovered uranium mill tailings account for only two-tenths of one percent of the natural radon in the air.

(b) In most cases, radon from uranium activities cannot be detected above background farther than one-half mile away from a uranium mine or mill.

(c) New Mexico state and industry officials are already committed to stabilizing tailings with at least a minimum of two feet of ground cover at a cost of $3 million to $15 million per site.

(d) The amount of radon in energy efficient homes is in some instances substantially higher than that permitted at the boundary of a uranium facility.

(e) The incidence of lung cancer for residents of the Grants Mineral Belt — which contains some of the nation's richest uranium deposits and where mining and milling activities have taken place since the early 1950s — is no higher than for the rest of the state and lower than the national average.

These perspectives show that it would be unreasonable to impose regulations on the uranium industry that are more severe than those the State of New Mexico have already imposed.

References

[1] "Comments on the Evidence and Suggested Language Changes by the Uranium Environmental Subcommittee (of the New Mexico Mining Association)," presented before the Environmental Improvement Board of the State of New Mexico, August 7, 1981.

[2] Ibid

[3] "Final Generic Environmental Impact Statement on Uranium Milling," United States Nuclear Regulatory Commission, September, 1980.

[4] "Comments on the Evidence and Suggested Language Changes by the Uranium Environmental Subcommittee."

[5] "Uranium: Fact or Fiction?," television documentary produced by Americans for the Rational Energy Alternatives, June, 1979.

[6] "Radon-222 in Energy Efficient Buildings," Lawrence Berkeley Laboratory, University of California, June, 1978.

[7] "U.S. Cancer Mortality by County: 1950-1969," DHEW Publication No. (NIH), U.S. Department of Health, Education and Welfare.

[8] Lewis [illegible], "Uranium Mill Tailings and Radon," Sandia National Laboratories, 1981.

[9] Thomas Buhl, "Radon and Radon Progeny Levels in New Mexico's Uranium Mining and Milling District," Environmental Improvement Division, January, 1981.

[10] This particular study by researchers at UNM Cancer Registry Center is still under way. The two following qualifiers should be added to the statement in the text. There may be a latency period for some of the miners in which case lung cancer may surface at a later date. The relative youth of the miners works to their advantage and as they age, they may experience lung cancer.

NEW MEXICANS FOR JOBS & ENERGY

Uranium Mining and Lung Cancer

The risk of lung cancer to uranium miners has received repeated media coverage in recent years. Unfortunately, the sensationalism surrounding the issue has done little but further confuse the general public. Although scientific journals contain numerous articles dealing with the question, very little has been done to give a comprehensive view of the possible hazards in laymen's terms.

What, if any, are the risks associated with uranium mining?

How do they compare with other risks?

Have mining practices improved over the past 30 years to reduce potential health hazards?

ARE THERE LEGITIMATE CONCERNS OR IS THIS JUST ANOTHER EXAMPLE OF THE MYTHOLOGY THAT SURROUNDS SO MANY NUCLEAR-RELATED QUESTIONS?

The following series of questions and answers attempt to deal with these subjects in order to provide perspective on the hazards of this important energy-related occupation.

1. Is there an increased risk of lung cancer for uranium miners?

Without doubt *excessive* exposure to "radon daughters" in underground mines may result in increased incidence of lung cancer. As with other carcinogens, effects at lower levels of exposure are smaller and difficult to evaluate. Most public health protection authorities consider it prudent to assume that *any* exposure to a carcinogen (including radiation) results in *some* risk, with the magnitude of the risk being roughly proportional to the magnitude of the exposure.

2. What is radon?

Radon is a naturally occurring radioactive gas and its decay products, called daughters, are also radioactive. Sources of radon exist everywhere on earth—in rocks, dirt, and common building materials. All of us are continually exposed to varying amounts of radon, but it tends to be highest in poorly ventilated enclosed spaces (including well insulated dwellings) and in mines where uranium concentrations are greatest.

3. It has been stated that early miners are being decimated by lung cancer. Furthermore, in a National Indian Council fund raising letter, it was claimed that 80 to 90% of present day miners will die of lung cancer. Is this true?

Neither statement is accurate. In the only completed study of lung cancer among American uranium miners, known as the Colorado Plateau Study, health records were examined for approximately 3400 miners who began work in the 1950's. There have been 205 cases of lung cancer among those early miners, or approximately 6% of the mining population. However, these early miners were typically exposed to radon and its daughters at concentrations *100 times* greater than concentrations permitted today, so one would expect that present levels of exposure will result in a major reduction in future cancer rates among present-day miners.

A second study, although not yet completed, is being conducted by epidemiologists at the University of New Mexico Medical School and Cancer Research Center dealing primarily with *New Mexico* uranium miners in the Grants Mineral Belt. Preliminary results, as of June 1980, indicate that 30 of 1825 miners had developed lung cancer, approximately 2% of that mining population. All the excess in cancer rates occurred in miners who began work before 1961, when exposure levels were higher than present day standards permit, although not as high as in the Colorado Plateau Study.

4. Were there more lung cancer victims than would normally be expected among these miners?

Yes, particularly in the Colorado Plateau Study. Among the 3400 miners in this study, 205 lung cancers were observed, where only 40 were expected. In the New Mexico study, there were seven more lung cancers than would have been expected.

5. But it was noted previously that the Colorado Plateau Study miners were exposed to radon at levels that are much higher than those present-day miners receive. What are today's miners exposed to?

The unit of measurement that is commonly used when speaking of exposure to radon and radon daughters in mines is the working level month (WLM). The maximum permissible dose for miners since 1971 has been 4 WLM per year. For those working the maximum 4 WLM/year for 30 years, total exposure would be 120 WLM. This *maximum* may then be compared to Colorado Plateau miners who often received 100 to 1000 WLM *in a single year.* Their cumulative exposure *averaged* 1180 WLM and some received as much as 7000 WLM.

6. Do all present day underground miners receive the maximum 4 WLM/year exposure?

No. In 1979, the average exposure for full-time workers, as verified by the Mine, Safety, and Health Administration (MSHA), which is the federal agency that regulates mine safety, was *1.5 WLM/year.* Over a thirty year career, cumulative exposures would be *45 WLM* for today's average miners.

7. Why are radon levels so much lower today than in the past?

Thirty years ago, scientific evidence as to the effects of radon was fragmentary and partially contradictory. Since that time, understanding of the potential hazards has improved greatly, and powerful ventilation systems have been installed in mines to protect miners from excessive radiation. Fresh air is forced into the mines, and air with higher levels of radon expelled.

In most of the larger mines (early Grants Mineral Belt mines fall in this category), some system of ventilation has always been used, although not at present-day standards. However, many of the early mines in the Colorado Plateau were small operations, called "dog hole" or "Mom and Pop" mines, where ventilation practices were poor or non-existent.

8. Is it just miners who smoke who have an added risk?

A decade ago that was believed to be true, but some of the recent follow-up studies of early miners indicate that this may not be the case. The latent period for cancers among smokers appears to be shorter, but non-smokers also may have an increased risk. However, the risk for miners who smoke is not just additive; i.e., their risk appears to be substantially greater than would be found simply by adding the risk of smoking to that of mining. Current regulations that forbid smoking underground are certainly justified, and additional health benefits will be reaped by miners who stop smoking altogether.

9. I understand that there is some risk involved in exposure to all levels of radiation, but is there any way of knowing how great the risk is?

Risk estimates can be made based on various studies that have been done on miners exposed to radon and its daughters. The Committee on the Biological Effects of Ionizing Radiation (BEIR), whose report[1] has been endorsed by the National Academy of Sciences, discusses five such published epidemiological studies. These studies present data on uranium miners in the United States, Czechoslovakia, and Canada; fluorspar miners in Newfoundland; and metal miners in Sweden.

10. How reliable are these studies?

Studies of this kind always have a degree of uncertainty depending on the data available to the researchers. Some of the studies mentioned in the BEIR report are extremely preliminary; others are more reliable because of better case histories of individual participants, and greater accuracy in determining levels of exposure.

The earliest of the published studies mentioned in the BEIR Report is the Colorado Plateau Study, first printed in 1962. Follow-up material has appeared at regular invervals, the latest in 1979. The study was the basis for setting present-day standards for maximum exposure in mines. No excess of lung cancer at present-day levels was noted.

During the last ten years, results of studies on miners in several other countries have become available. Some of these data do suggest an excess of lung cancer at present-day radon exposure levels, although it is not proven that the radon caused the excess cancers. All of the studies have their problems, and there is some disagreement among researchers as to which should receive the most emphasis in estimating risks and setting health protection standards. Despite these problems, there is a range within which risk estimates fall.

11. What is the range of risk estimates discussed in the BEIR report?

For underground workers having age distributions typical of miners, the BEIR report cites results of studies that span a range of about 3.5 to 30 excess cases of lung cancer annually per million people for each working level month of exposure.

Translated into layman's terms, today's average miner, who is exposed to 1.5 WLM/year (45 WLM over a thirty year work period), would have an additional lifetime risk of developing lung cancer that falls somewhere between 0.5% and 4%. For comparison, the average risk of dying of lung cancer for a U.S. male is between 6% and 7%, based upon current lung cancer statistics.

12. Is uranium mining unique in carrying disease-related risks?

Hardly. Black lung disease among coal miners is a well publicized example. Furthermore, a 1980 U.S. Department of Labor[2] study indicates workers exposed to silica, cotton dust, beryllium, cadmium, arsenic, chromium, nickel and coal tar products all run an increased risk of contracting occupationally related pulmonary and respiratory diseases. There are approximately 1.9 million U.S. workers engaged in trades related to the above materials, compared to 3400 in the uranium mining industry.

Asbestos exposure appears to be one of the worst of the occupational problems. A recent alarming (and controversial) report prepared by researchers at the National Cancer Institute[3] claims that as many as 2 million of the 8 to 11 million U.S. workers who have been potentially exposed to asbestos will eventually die of asbestos-related cancers. Even if this prediction proves exaggerated, the uranium miner problem is obviously dwarfed by other public health problems of comparable kind.

13. Doesn't uranium mining—and other occupations, too—carry risks that have nothing to do with radiation? How do these other risks compare with the radiation risks of uranium mining?

All types of mining, including uranium, have high occupational risks due to the nature of the work itself. There are other occupations, however, that have comparable and even higher risks. The following chart shows the average loss of life expectancies for various occupational and environmental risks. A comparison can then be made with the average loss of life expectancy due to radon for uranium miners, based again on risk estimates of epidemiological studies in the BEIR report.

Deaths from Occupational Accidents in the United States[4]

INDUSTRY TYPE	LOSS OF LIFE EXPECTANCY (Days)
Motor freight	1170
Firemen	1020
Policemen	1020
Local transit	910
Railroad	660
Mining, quarrying	328
Construction	302
Agriculture	277
Oil, gas recovery	145
Service	47
Trade	30
All Industry	74
Societal Risks[5]	
Cigarettes (1 pack/day)	2200
Being 10% overweight	400
Motor vehicle accidents	200
Lung Cancer Risk from Radon Exposure	
45 WLM average cumulative exposure	26-219

15. In other words, there are risks associated with many occupations?

Yes, and the chart presented above is meant to place radiological risks associated with uranium mining in perspective. We do not live in a risk-free society. Before society can make judgments on which risks it deems unacceptable, it must be able to estimate the magnitude of risk, and compare the benefits with the possible adverse effects. In the case of uranium, one has to consider the risks of other energy alternatives, and the risk of energy famine.

Although radiation has become an emotionally charged issue, the fact remains that workers are no more dead from lung cancer in uranium mines than black lung disease in coal mines, drowning at off-shore oil platforms, or accidents in the course of transporting natural gas or materials for solar collectors.

The statement has frequently been made that "we don't know what the dangers of radiation are." This simply is not true. Radiation has been more carefully studied and is better understood than many other potential health hazards, including most other carcinogens. One of the purposes of this paper has been to show that estimates of risks fall within a fairly well defined range based on epidemiological studies. As these studies become more refined, the range of risk estimates will narrow, and as technology improves, the risks will continue to decrease.

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[1] "The Effects on Population of Exposure to Low Levels of Ionizing Radiation," Report of the Committee on the Biological Effects of Ionizing Radiation, National Academy of Sciences, 1980.

[2] "An Interim Report to Congress on Occupational Diseases," U.S. Department of Labor, 1980.

[3] "Estimates of the Fraction of Cancer in the United States Related to Occupational Factors," National Cancer Institute, 1978.

[4] National Safety Council, 1977, and U.S. Public Health Service, "Vital Statistics—Special Reports," 1982.

[5] B. Cohen, and I. S. Lee, "A Catalogue of Risks," *Health Physics*, 1979.

This article was written by Evelyn Saucier and Dave Williams after more than a year of extensive study and research.

During 1982, NMJE will publish two more articles on uranium. The second article will deal with the impacts of uranium mining and milling on water; the third on the impacts of uranium mining and milling on the general public.

Economic Benefits of Uranium Mining and Milling in New Mexico

NMJE feels that risks associated with uranium mining and milling need to be assessed along with the economic benefits to workers and the general public.

Here are some of the benefits of be considered.

1. 6,000 people are currently employed in New Mexico's uranium industry.

2. Each of these jobs creates 1 to 2 support jobs.

3. New Mexico uranium production in 1980 created about $371,000,000 in real wealth. The bulk of this money was spent on taxes, supplies and labor. ($17,215,000 of this amount went to the State as severance taxes.)

4. Nuclear power plants created 11% of the nation's electricity in 1980.

5. In 1980, for the first time, nuclear energy produced more electricity for the U.S. than oil.

6. More than 70,000 workers are currently employed in the construction of nuclear power plants in the U.S.

7. By the year 2000, 27% of the electricity in the U.S. will be produced by nuclear power plants.

8. In 1978, nuclear power displaced the need for 470 million barrels of imported oil.

UNC MINING AND MILLING

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July 18, 1983

Senator Pete Domenici
Committee on Environment and
Public Works
United States Senate SD-410
Washington, D.C. 20510

Dear Senator:

This letter is in reference to the hearing you held recently in Albuquerque relative to environmental matters.

I wish to thank you on behalf of United Nuclear Corporation for the concern demonstrated on your part for the environmental well being of the citizens of the state of New Mexico and, indeed, the country. Hearings such as these provide an excellent opportunity for you to become more familiar with the concerns of those of us dealing with the subject on a daily basis. Mr. Ruckelshaus' attendance was also greatly appreciated. We sincerely hope that your efforts will result in more reasonable and equitable environmental legislation and policy direction in the area of environmental regulation.

I would also like to take this opportunity to comment briefly on a particular portion of the written statement provided you by Mr. Jay B. Sorenson of the Sierra Club. I will not burden you with a discussion of our differing views with Mr. Sorenson. However, I think it necessary to point out a serious error in his statement relative to the UNC Churchrock mill tailings spill and his misconception that it has created a thorium contamination problem.

The spill occurred on July 16, 1979. It was caused by a breach in the extreme southernmost section of the retention dam. All liquid and solid material that escaped moved in a southwesterly direction. The great majority of the solids which escaped were deposited a short distance downgradient prior to reaching the arroyo. The liquids and some solids entered the arroyo and were carried to the Rio Puerco approximately 4 miles downgradient. Those solids that were carried into the water course were deposited along the banks of the arroyo and the Rio Puerco.

Immediately after the spill an intensive effort was initiated to clean up the spill and monitor and assess its impacts. A great deal of company effort was expended in ensuring that the spill was cleaned up to acceptable levels, as established by the New Mexico Environmental Improvement Division (NMEID). Several exhaustive independent studies have been conducted by organizations such as the Environmental Protection Agency, the Center for Disease Control (CDC), the NMEID and the Lutheran Church which assess the impacts on the health and welfare of the public and the environment as a result of the spill. Without exception, each study has concluded that any impacts were short-lived and that there have been no long term impacts attributable to the spill.

Mr. Sorenson mistakenly represents that present thorium contamination identified by NMEID has been caused by the spill. Nothing could be further from the truth. The thorium contamination occurs in two wells located in the extreme northeast corner of the facility, almost one mile from the location of the spill, and is occurring in a direction 180 degrees opposite the direction of flow which the spill took.

We do not point to this error to lessen the severity of concern regarding the subject of seepage. We do, however, view this as another example of the misrepresentations made and complete disregard for facts which the uranium industry continues to experience. Had Mr. Sorenson investigated the thorium seepage situation he would have found that the NMEID and the company have agreed as to the source of seepage (i.e. liquids contained in the north side of the facility) and that the company has initiated a program to clean it up. UNC would be very appreciative if this letter were to be included in the hearing record in order to rectify Mr. Sorenson's error.

In closing, I would like to again thank you for your interest and concern relative to environmental issues. I trust that the information provided herein clarifies the situation regarding thorium seepage and the spill at Churchrock. For too long this unfortunate incident has been used as a pedestal for unfounded accusations. If you require additional information or I can be of any assistance in the future please do not hesitate to call on me.

Respectfully yours,

Juan Velasquez
Manager, Environmental Affairs

JV/jh
cc: Mr. Ruckelshaus

Hearing in Albuquerque, N. M.

July 6, 1983

Statement by Gladys R. Winblad
6000 Buena Vista, N. W.
Albuquerque, N. M. 87114

To: Senator P. Domenici, U. S. Senate Environment and Public Works Committee

I am concerned about the plan of Molycorp to build a new disposal area three miles west of Questa, N. M. on 1320 acres of BLM land. The area will contain 200 million tons of molybdenum tailings, and will have a dam up to 400 feet high.

It has been decided that an EIS (Environmental Impact Statement) is not needed. An EA (Environmental Assessment)has been done which points out some problems with the project, including the following:

3600 acre feet per year of water (almost 5 cubic feet per second) of seepage will occur, and the water is expected to reach the Wild and Scenic River section of the Rio Grande in one year.

I urge that a full EIS be done, as required by NEPA (National Environmental Policy Act).

I strongly object to the polluting of New Mexico water, both surface and underground, that has been allowed to occur in the past.

I believe that tailings ponds containing dangerous elements should be lined, so that seepage does not occur, and much greater should be taken to protect the health of our people from water pollution.

Gladys R. Winblad
Gladys R. Winblad
7-6-83
Date